Instruction Report R-95-1
October 1995

US Army Corps of Engineers
Waterways Experiment Station

Natural Resources Research Program

Regional Recreation Demand Model for Large Reservoirs: User's Guide and Model for Documentation, Version 1.0

by Frank A. Ward, Kevin A. Martin
New Mexico State University

Prepared for Headquarters, U.S. Army Corps of Engineers

PRINTED ON RECYCLED PAPER

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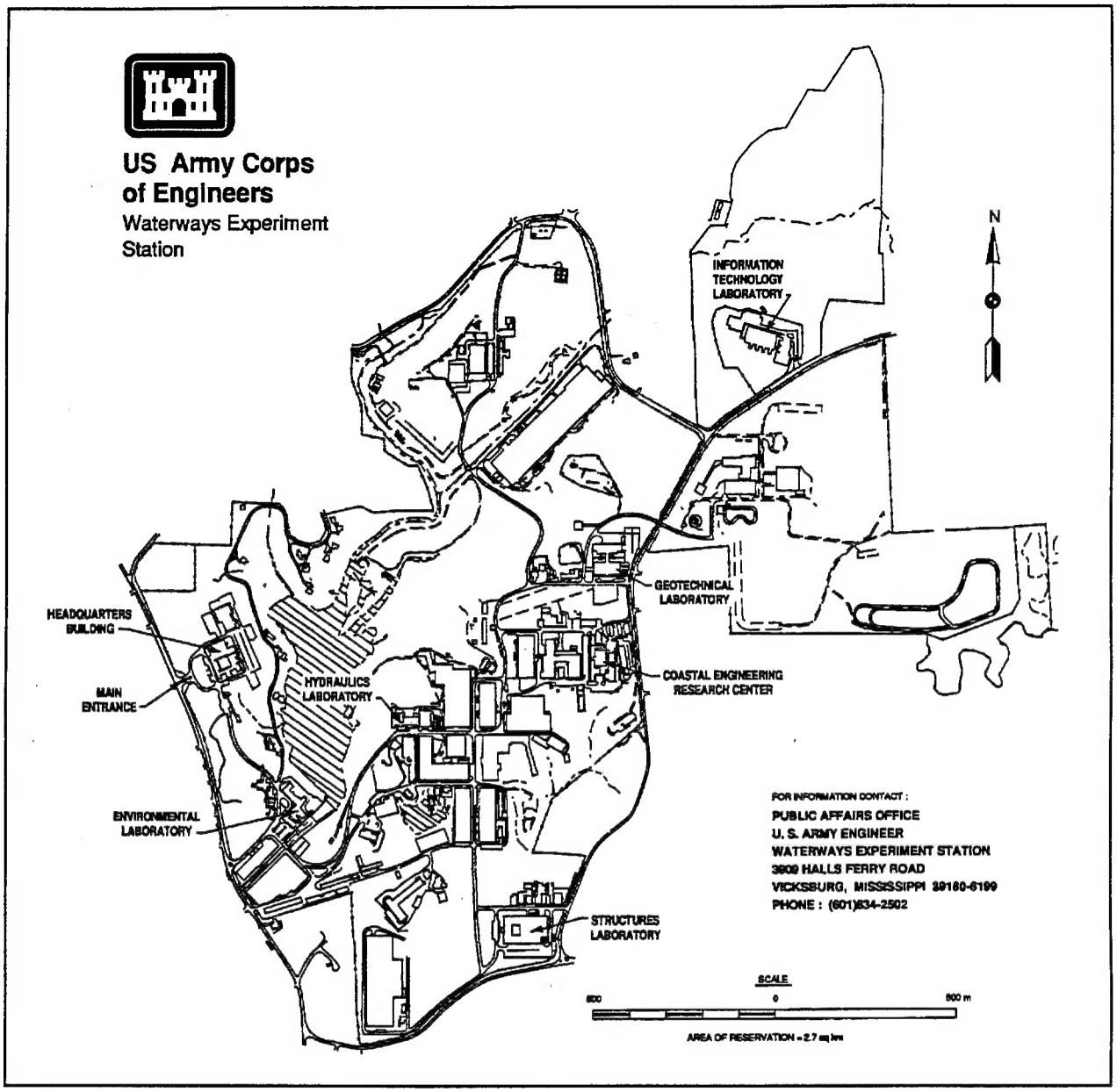
Final report

Approved for public release; distribution is unlimited

Prepared for U.S. Army Corps of Engineers
Washington, DC 20314-1000

Under Work Unit 32574

Monitored by U.S. Army Engineer Waterways Experiment Station
3909 Halls Ferry Road, Vicksburg, MS 39180-6199



Waterways Experiment Station Cataloging-in-Publication Data

Ward, Frank A.

Regional recreation demand model for large reservoirs : user's guide and model for documentation, version 1.0 / by Frank A. Ward, Kevin A. Martin ; prepared for U.S. Army Corps of Engineers ; monitored by U.S. Army Engineer Waterways Experiment Station.

75 p. : ill. ; 28 cm. -- (Instruction report ; R-95-1)

1. Reservoirs -- Recreational use -- Planning. 2. Outdoor recreation -- Planning. I. Martin, Kevin A. II. United States. Army. Corps of Engineers. III. U.S. Army Engineer Waterways Experiment Station. IV. Natural Resources Research Program (US Army Corps of Engineers) V. Title. VI. Series: Instruction report (U.S. Army Engineer Waterways Experiment Station) ; R-95-1.

TA7 W34i no.R-95-1

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Preface

The work reported herein was conducted as part of the Natural Resources Research Program (NRRP) work unit, Regional Recreation Demand Model (RRDM) (Work Unit 32574). The NRRP is sponsored by the Headquarters, U.S. Army Corps of Engineers (HQUSACE), and is assigned to the U.S. Army Engineer Waterways Experiment Station (WES) under the purview of the Environmental Laboratory (EL). Funding was provided under Department of the Army Appropriation No. 96X3121, General Investigation. The NRRP is managed under the Environmental Resources Research and Assistance Programs (ERRAP), Mr. J. L. Decell, Manager. Mr. Russell Tillman was Assistant Manager, ERRAP, for the NRRP. Technical monitors during this study were Mr. Robert Daniel and Ms. Judy Rice, HQUSACE.

The report was prepared by Dr. Frank A. Ward and Mr. Kevin A. Martin, New Mexico State University. Review and comments were provided by Messrs. Jim Henderson and Scott Jackson, EL, and Mr. Dan Allen, Louisiana State University.

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At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander was COL Bruce K. Howard, EN.

This report should be cited as follows:

> Ward, F. A., and Martin, K. A. (1995). "Regional recreation demand model for large reservoirs: User's guide and model for documentation, Version 1.0," Instruction Report R-95-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Summary

This report is a user's guide and documentation of a regional recreation demand model estimated for U.S. Army Corps of Engineers (USACE) reservoirs. The software allows managers who use the model to predict recreation visitation and economic benefits at USACE or similar large reservoirs resulting from potential management actions. Access to information provided by this model has the potential to save time and resources when conducting economic appraisals of natural resource management plans.

An estimated travel cost model predicts recreational use and benefits at USACE reservoirs in the Sacramento, Little Rock, and Nashville Corps of Engineers Districts. The data needed by the model are stored in databases that can be accessed through user-friendly computer screens to set up scenarios to evaluate impacts of management actions. There are 23 reservoirs currently in the database. For reservoirs not in the model's existing databases, the user can define the data needed by the model by means of screens that prompt the user to furnish information characterizing reservoir facilities and demographics of the surrounding market area. Resulting model predictions forecast day use and camping use visitation and economic benefits at large reservoirs.

The software can be used by resource managers with limited background in economic analysis. The model complements a manager's detailed understanding of a reservoir, its facilities, its visitors, and characteristics of its market area. Additional information regarding the assembly of the database and formulation and estimation of the models can be found in Roach (1994).[1]

[1] Roach, B. (1994). "Regional recreation demand model for large reservoirs, database assembly, model estimation, and management applications," unpublished Ph.D. diss., Department of Ecology, University of California, Davis.

Conversion Factors, Non-SI to SI Units of Measurement

Non-SI units of measurement used in this report can be converted to SI units as follows:

Multiply	By	To Obtain
acres	4046.873	square meters
miles (U.S. statute)	1.609347	kilometers

1 Background Problem

Economic performance is central to the formulation, implementation, and evaluation of public natural resource management plans. Management actions of the various public natural resource agencies including the U.S. Army Corps of Engineers (USACE) are under scrutiny from the Congress, various special interest groups, and the general public. Consequently, these agencies need access to information that accurately measures the economic consequences of a wide range of potential natural resource management actions.

Conducting an economic evaluation of every potential management action is expensive and should be performed by analysts trained in the use of methods of economic analysis. The considerable expense required for each economic analysis of natural resource management limits the scope and depth of economic appraisals that can be carried out for any given plan.

There is a considerable need for management tools that can be used by policy analysts to quickly and efficiently evaluate the economic performance of a policy before its implementation. For example, the U.S. Department of Agriculture (USDA) Forest Service has developed FORPLAN.[1] FORPLAN is a linear programming model that selects timber harvest schedules and land improvement measures to maximize the present value of net economic benefits in connection with forest management plans. The New Mexico Department of Game and Fish has developed RIOFISH,[2] a comprehensive, interdisciplinary model of New Mexico's reservoirs and streams, fish production, and associated economic benefits. RIOFISH is used by fisheries managers in New Mexico to estimate economic benefits of fisheries management plans. Both of these models allow a policy analyst to evaluate the economic consequences of a potential management action for managers with limited background in economic analysis.

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[1] Johnson, K. N. (1986). "FORPLAN Version 1: An overview," Land Management Planning Systems Section, USDA Forest Service, Fort Collins, CO.

[2] Cole, R. A., Ward, F. A., Ward, T., Bolton, S., Dietner, R. A., and Fiore, J. (1990). "User's guide for RIOFISH: A fishery management model for large New Mexico reservoirs," Technical Completion Report, New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces, NM.

The USACE has for some time considered investing in the development of a model to estimate recreation visitation and economic benefits resulting from a range of management actions. Access to the information provided by a model has the potential to save considerable time and resources when conducting economic appraisals of management plans. In May 1991 the USACE funded a study for which the objective was to develop a series of regional recreation demand models (RRDM) for conducting economic analysis of its recreation management plans.

The user's manual presented herein complements the software that allows a user to access existing data and apply the estimated models described by Roach[1] to numerous issues relating to the management of large reservoirs. Using interactive screens the user can see and modify reservoir quality and demographic information regarding the surrounding market areas of reservoirs in the model. (Instructions for obtaining a copy of the software are provided at the end of this report.)

The models were estimated using travel cost methods to predict the visitation and economic benefits resulting from management actions. The travel cost model is based on the travel costs visitors pay to visit a reservoir. Demand is predicted for camping and day use at each of several reservoirs. The contribution made by the software developed for the model and described in this user's manual is to make the RRDM accessible. All parameters, variables, and equations that characterize the model including the dBase source code are presented in Appendices A-E.

Economic benefits are calculated by the RRDM software using predictions of demand. Benefits are measured as entry fees selected by the model user plus resulting consumer surplus. Consumer surplus is measured as the difference in the travel cost a visitor pays to visit a reservoir including entry fees and the maximum travel cost observed by visitors who travel from the edge of the market area. The greater the difference between what a visitor actually pays and the maximum they are willing to pay, the greater is the benefit to the visitor.[2]

Benefits in the RRDM software measure the direct value of the resource to the recreational user, defined as the maximum amount the user would pay for the resource rather than forego access to the reservoir. These benefits are sometimes called "primary benefits" in cost benefits analysis. They typically are termed "national economic development" (NED) benefits by the Federal water agencies. RRDM does not measure secondary benefits, such as income

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[1] Roach, B. (1994). "Regional recreation demand model for large reservoirs, database assembly, model estimation, and management applications," unpublished Ph.D. diss., Department of Ecology, University of California, Davis.

[2] Johansson, P. (1987). *The economic theory and measurement of environmental benefits.* Cambridge University Press, Cambridge, MA.

to concessionaires and to local communities from related recreational expenditures.

Results are displayed as the sum of benefits to all visitors from the market area surrounding a specific reservoir. These benefits can be used in conjunction with analysis for which benefits are compared with costs of implementing management actions.

The model uses data for reservoir facilities and for the demographics of counties[1] surrounding the reservoir within a market area radius of 150 miles.[2] Data are included for 23 Corps reservoirs in the current version of the model. The model user can also create a database for reservoirs not within the database of the model. For specific information on setting up a scenario using a reservoir not in the dataset, see Chapter 10.

By allowing a model user to create a database for any large reservoir, RRDM can be used with any body of water with actual or potential public recreation facilities. However, there are three limitations of RRDM:

a. The body of water should possess characteristics of a lake or reservoir. Streams, rivers, or aqueducts may produce unreliable results.

b. All variables required by RRDM need to be defined.

c. Data used to define reservoir facilities and demographics should be from the same year to the extent possible.

The RRDM model was estimated for USACE reservoirs of size exceeding 1,630 acres. The performance of the model on smaller reservoirs has not been tested to date (July 1994). It is advisable for predicted visitation and benefits to be compared with observed visitation at the reservoir in question. The calibration option described in Chapter 7 can be used to correct for differences between observed visits and visits predicted by the model.

The RRDM software predicts visitation and economic benefits using models estimated for the Sacramento, Little Rock, and Nashville Districts of the USACE. A fourth model is incorporated into RRDM that was estimated using pooled data for all three Districts. This pooled model allows RRDM to be transferred to a wide range of resource management problems and recreation reservoirs outside the specific Districts for which the database was assembled.

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[1] Travel distance is measured from the reservoir to the largest city in each county within the market area.

[2] A table of factors for converting non-SI units of measurement to SI units is presented on page viii.

2 Introduction to Software

The software described herein provides information for resource managers who wish to evaluate impacts of management plans on recreation benefits and visitation at USACE projects or similar large reservoirs. In the software there are two classes of reservoirs for which management actions can be evaluated. In the first class, the user can select one of 23 existing study projects in the Sacramento, Little Rock, and Nashville USACE Districts. The second class of reservoirs is considerably more versatile. In it a user can characterize data for a non-study project (i.e., a project not in the model's existing database). This is done by defining all of the project facilities, zone of visitor origin demographics, and travel distances from the zones to the reservoir. Selection of this second option allows the user to simulate management actions at existing non-study projects or to design and evaluate a proposed project.

The software is designed to allow economic assessment of recreation visits and associated benefits *without* and *with* management actions. To initiate the assessment, several steps are required. First, the user must define a geographic scope for the reservoirs. Setting the geographic scope means choosing the reservoir and District to be used for analysis. After choosing a reservoir and District, the user must define project and demographic data under existing management conditions and those for potential future actions. Then the model computes visitation and benefits for both the existing and potential policies and computes the differences in each. Separate analysis is performed for both camping and day use visitation.

Results of a model run can either be printed to the monitor screen for viewing, stored in a file, or sent to a printer. If the complete version of the output is selected, the model produces the following:

- Time and date of each model run.
- Title of the output page (specified by user).
- Project name.
- Each zone of origin.
- Visits from each origin county without and with the management action.

- Net benefits from each origin county without and with the management action.
- Change in visits and net benefits from each origin county due to the management action.
- Total project level visits and benefits without and with the management action.
- Change in project level in visits and benefits resulting from the management action.

The RRDM software is written in dBase IV. It is a standalone DOS executable version and can be run on any IBM-compatible personal computer with DOS version 3.0 or higher.

3 Installing the Software

The files on the RRDM disk are compressed to save disk space. Instructions for the user are as follows. Make a copy of the original disk before attempting to install the program. Install onto a hard drive using the copied disk. About 3 megabytes of hard disk space are needed for the complete model and its directories. Install using the following steps: Start from the DOS prompt and create the directory RRDM. The command for creating this directory is **md RRDM**.

Change the working directory to RRDM by typing **cd RRDM**. A prompt similar to C:\RRDM will appear depending on your hard drive letter (e.g., C, D, E, etc.). From the RRDM directory, copy the contents of the floppy disk into RRDM using Steps A-D described below.

Step A. Put floppy disk in drive.

Step B. **Copy a:*.*** (or the letter of the drive placed on the installation disk).

When all files are copied into RRDM,

Step C. Type **INSTALL** to expand the newly copied files. A message will indicate when installation is complete and the model is ready to run.

Step D. Type **RRDM** to run the program.

The main menu will appear on the user's screen. The model is now ready to run.

4 A Quick Run Through the Menus

This chapter describes the general flow of menu runs in the model. Reference is made to the flowchart shown in Figure 1. Detailed use of menus is discussed in Chapter 5.

Main Menu Part 1: Select Projects

From the Main Menu Part 1, choose one of three steps:

a. Upload saved data from a previous run (box 1.1).

b. Define a non-study project (box 1.2).

c. Select an existing study project (box 1.3).

To select from any menu, use the up and down arrow keys to move the highlight bar (cursor) to the desired selection and press Enter.

Upload baseline data

This feature allows the user to upload a file saved during a previous model session. Go to menu 1.1 and skip menus 1.2 and 1.3. Selecting this option will prompt for a file name. After entering the name of the previously saved file, proceed directly to the Main Menu Part 2, described later.

Define a non-study project

Define a non-study project or a project that does not currently exist. The complete data set characterizing this project can be built using menus 1.2.1 through 1.2.4. After that, use menus 1.3.1 through 1.3.4 to prepare the model to compute visitation and benefits with the defined data set.

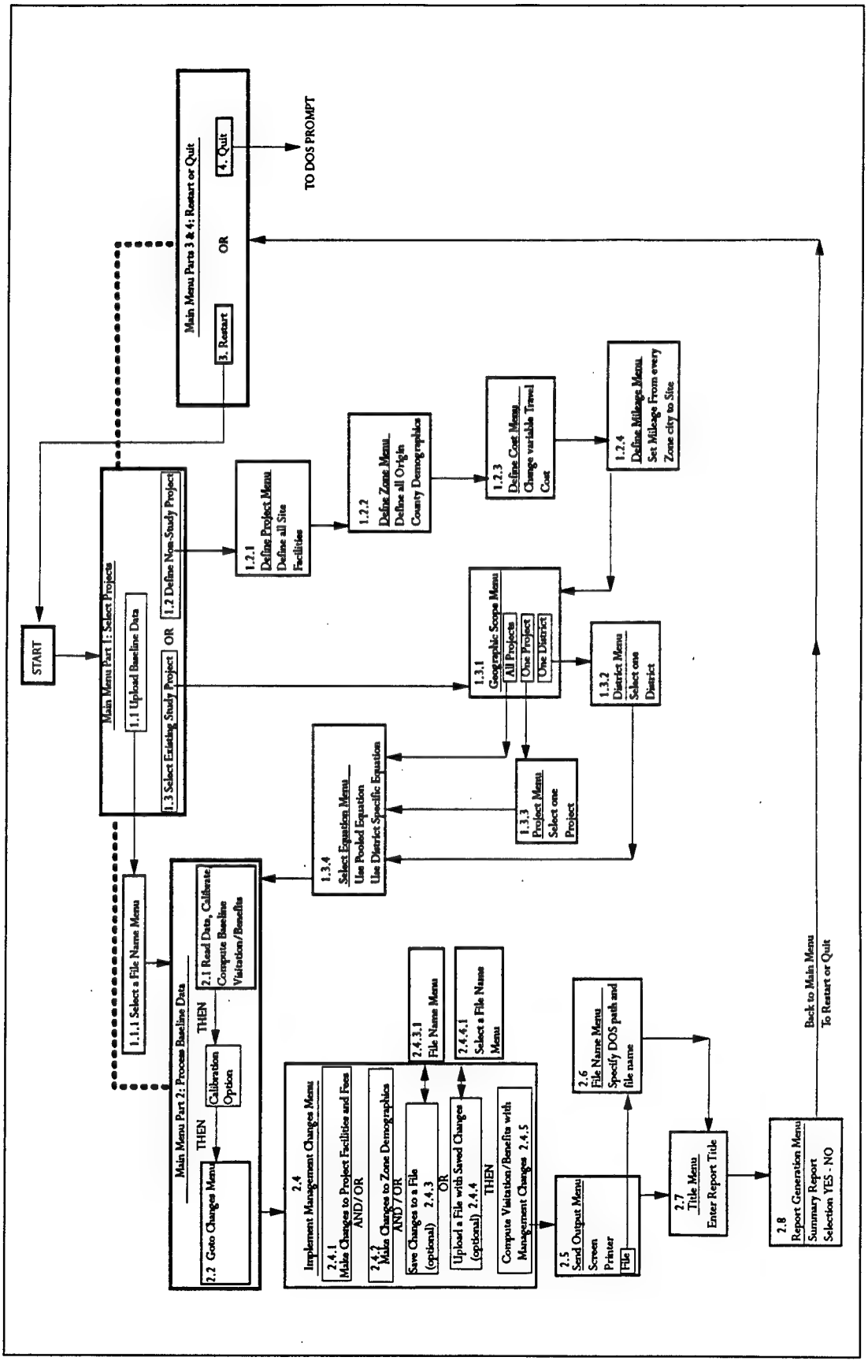

Figure 1. Flowchart for RRDM

Select an existing study project

Select an existing study project; read the data set that characterizes that project by using menus 1.3.1 through 1.3.4. These menus set the geographical scope, select a District, select a project, and select one of eight models to use.

Main Menu Part 2: Process Baseline Data

This menu (box 2.1) allows the user to read data, calibrate the model, and compute baseline visits and benefits before implementing management actions. After the baseline data have been processed, pass through the "Go to Changes Menu" (box 2.2) before proceeding to the "Implement Management Changes Menu" (box 2.4).

Implement Management Changes

This menu (box 2.4) allows the implementation of four kinds of management actions before calculating their impacts on visitation and benefits.

First, the user can implement management changes to project facilities or implement fees at the project (box 2.4.1). This means the user can change characteristics of a particular project to reflect potential management actions. For example, to change the number of picnic tables that exist at a reservoir, do so by entering the new number of tables in this menu.

Second, the user can change demographics at visitor zones of origin (box 2.4.2). Changes can be made to such variables as the population, average age, and average income. This is done in a manner similar to that for the facility variables. The menu allows the user to view the values of all demographic variables and then make changes by entering new values.

Third, the user can save any changes to a file on hard disk (box 2.4.3, 2.4.3.1). If a long time is spent entering data for a non-study project, this option allows for saving all data. There is no need to re-enter the data when needing to use it again in future model runs if files are saved with unique names. When selected, the user is prompted to enter the file name under which to save the data (box 2.4.3.1).

Fourth, the user can upload a file containing previously saved management actions (box 2.4.1, 2.4.4.1). If previous changes were made reflecting management actions, they may be uploaded at this point to use with a current model session. There is no need to re-enter the same changes made in a previous session. A file can also be uploaded and re-edited to modify any changes made in previous sessions. When selected the user is prompted to select a file name from a list of current files. The file selected will automatically be uploaded and made ready to view or change.

Last, after performing whichever of the preceding steps is required for implementing a management action, the user is ready to proceed to run the model. The model run computes visitation and benefits resulting from the management actions (box 2.4.5).

Generating Output

At this point the model allows for viewing visits and benefits computed during the model session. In the Send Output Menu (box 2.5) choose one of three locations to send results. If the user chooses a file, the model will prompt the user at the File Name Menu (box 2.6) to enter the file name for which to save the output. This option is best for viewing information at a later time. The user may title output from the Title Menu (box 2.7) before sending it to a file or to a printer if needed. The last option produces a summary report or a full report of visits and benefits from the Report Generation Menu (box 2.8). These are discussed in greater detail subsequently.

Main Menu Parts 3 and 4: Restart or Quit

After running the model and generating results, restart the program with a new scenario or quit the model and return to the DOS prompt (boxes 3 and 4). Restarting sets all variables to default values and readies the model to start another session. The quit option will shut down the model environment and return to the DOS prompt. With this brief overview of the RRDM software, the user may proceed to more detailed discussion in the following chapters.

5 Detailed Use of the Menus

This chapter describes the purpose, input, and output of each menu in Figure 1. Use the keystrokes listed in Tables 1 and 2 to move around the screens of RRDM. Figure 1 will help you keep track of your location and help you follow the progress of the text.

Getting Around in the Screens

Move around the user screens by using the keystroke combinations listed in Tables 1 and 2. Table 1 lists the commands to move around the screen while entering new data to the screens. Table 2 lists the commands for saving or continuing without saving the data entered. Each command is also listed at the bottom of each user screen while the model is in operation.

When finished with one screen save the data and go to the next screen with the commands in Table 2. If a mistake is made the user can continue without saving any information to the database.

Main Menu Part 1: Select Projects

A session begins by selecting one of three kinds of analysis. To upload a file saved from a previous session using either an existing study site or a non-study site, choose "Upload Baseline Data" (box 1.1). To define an existing non-study reservoir or a proposed reservoir and its counties of visitor origin, choose "Define Non-Study Project" (box 1.2). To analyze a change on an existing study reservoir choose "Select Existing Study Project" (box 1.3). Each option is described in detail below.

Upload Baseline Data (1.1)

Choose this option to use a file that was previously saved (box 1.1). This option allows the user to retrieve data from a previous session and perform economic analysis with it. The user is shown a list of all available files for

Table 1
Commands for Moving Around, Between, and Within Screens

Keystroke	Action Performed by Keystroke
TAB	Move forward one entry
SHIFT-TAB	Move back one entry
ARROW KEY	Move forward and backward one data entry

Table 2
Commands for Saving Information From a Screen

Keystroke	Action Performed by Keystroke
CTRL-END	Save changes and move to next screen
ESC	Do not save changes and move to next screen

uploading. Use the arrow keys to move the highlight bar to the file name to use and press ENTER. The model will copy all the information in the file to run in the current RRDM session.

There is no need to set the geographic scope since all information regarding these menus (boxes 1.3.1 through 1.3.4) is already saved in the file uploaded. Proceed to the Main Menu Part 2: Process Baseline Data to use the information uploaded to run the model.

Define a Non-Study Project (1.2)

Choose this option to conduct an economic analysis for a project not in the model's database (box 1.2). Its application is for existing non-study projects or for proposed projects. It allows the user to define every project facility, origin county, and travel distance the model uses to calculate visits and benefits. The user is shown a series of data screens in which to enter values for all variables that characterize a project and its surrounding market area. These variables are entered from four separate screens shown to the user sequentially in boxes 1.2.1 through 1.2.4. The analysis is done for a single project one at a time. However, any number of origin counties can be entered for the project.

To define a non-study project, find the values for both reservoir and all zones of origin. The user is shown a series of screens to enter data for a reservoir and all its zones of origin from various outside reference sources. In case the user is uncertain about the units, the mean values of every variable used for the Sacramento, Little Rock, and Nashville Districts are listed in parentheses. The user can enter the average as a default if lacking access to better data.

Define Project Menu (1.2.1)

Enter all information regarding the facilities of a single reservoir in predefined formats. The format is given to the right of each variable name in parentheses. The program requires that data be entered in the correct format. Once changes have been made press CTRL-END to save the changes and go on to the next screen. If no changes are made or you do not wish to save your changes, press ESC to leave without saving. A complete list of variables to define appears in Appendix B.

Define Zone Menu (1.2.2)

This menu allows the user to code in demographic data of any number of counties. Enter each county one at a time. The example run presented in Chapter 10 illustrates the process. The largest city in each county occurring within 150 miles of the reservoir being evaluated is found. Data for the largest city are used to represent the county's demographics. When you have finished defining each variable on the screen and the cursor is at the last field, press Return to enter the next county. The program asks if the user wishes to add another record. Answer "Yes" and a blank screen will appear for you to fill out. Continue these steps for as many counties as needed.

To view demographic data for previously defined counties, place the cursor on the first field (CITY NAME) and press SHIFT-TAB. This will move the cursor to the previous county defined. To go forward to the next county move the cursor to the last field on the screen and type either ENTER or TAB. This action moves the cursor to the next county previously chosen.

Define Cost Menu (1.2.3)

This screen allows the user to define variable travel cost per mile to avoid the default data. Travel costs per mile are measured as the variable cost in cents per mile of owning and operating a vehicle. For the years 1984-86, these costs were about $0.06 per mile. The U.S. Department of Transportation publishes updates periodically. (Note that these costs are not current.)

Define Mileage Menu (1.2.4)

Enter round-trip distance from each origin city previously defined to the reservoir to be analyzed. The distance to the largest city in every county in the market area is used to calculate the travel time to the reservoir. At the top of the screen is listed the reservoir name and the origin city needed for the distance. Type in the distance and press ENTER. The next city name will appear. Repeat this process for every city defined for the model run. To go

back to any previous city to change or view mileage, press SHIFT-TAB to go back in the list. When the city to review appears, enter a new mileage and press RETURN. Use TAB to move forward in the list of cities if necessary. When all mileages are entered, press CTRL-END to save the information and continue.

The result of the steps 1.2.1 through 1.2.4 creates a machine-readable database that does not exist in the default database of RRDM. Once all of the variables are defined, the user can move to the next step that configures the newly defined database for use by the model.

After defining a new reservoir, the user is shown a series of option menus regarding the study reservoir (1.3.1 through 1.3.4). Going through these menus sets up the database for use by the model.

Geographic Scope Menu (1.3.1)

After defining the desired project and its associated counties of origin and travel costs the information is processed for use by the model. This menu organizes all the defined data into a format for the RRDM software to use. The process is performed by selecting the desired option from menus 1.3.1 through 1.3.4.

Choose "One Project" from Geographic Scope Menu 1.3.1 since only one reservoir is defined for the scenario in which a non-study project is created. When selecting "One Project" the user is shown the name of the reservoir previously defined. Press ENTER to confirm and continue to the next menu. Choose the equation to use for the model run from Select Equations Menu 1.3.4 and press RETURN. The model returns to the Main Menu Part 2 to process baseline data.

6 Select an Existing Study Project (1.3)

Use of the menu shown in Figure 1 as box 1.3 selects one of 23 reservoirs that exist in the database. No additional definition steps are required since the database already contains information regarding the project and origin counties.

Geographic Scope Menu (1.3.1)

To set up the database for use by the model requires the Geographic Scope Menu (boxes 1.3.1 through 1.3.4). This menu (box 1.3.1) lets you choose a District and project to analyze and prepares data for the model to use. To run the model for an existing study project you may elect to run one study reservoir in one specific District, all study reservoirs in all three Districts, or all study reservoirs in one District. Depending on the selection (from 1.3.1), the user will be asked to select either a specific project or District by name.

Project and District Menus (1.3.3 and 1.3.2)

The Project Menu (1.3.3) and District Menu (1.3.2) both allow selection of a project location by name. To run the model for a particular project from the Geographic Scope Menu, select a reservoir from a list of Corps study projects shown. To run the model for an entire District from the Geographic Scope Menu, select the particular District from the list shown in the District Menu (1.3.2).

After selection of Project or District options, specify the model to be used. The description of each choice is as follows.

"Use Pooled Equation" selects a set of equations that have been developed to estimate visits and benefits with data pooled from Little Rock, Nashville, and Sacramento Districts. This is the most general form of the model, with the greatest transferability to unstudied regions.

"Use District Specific Equation" selects a set of equations developed for the District containing your chosen reservoir. For example, if Black Butte reservoir is selected from the Project Menu and "Use District Specific Equation" is selected, the model would pick the equation estimated for the Sacramento District. After the user makes this choice, the model reads all the data from the projects selected, and then prepares to compute baseline visits and benefits by returning to Main Menu Part 2.

7 Main Menu Part 2: Process Baseline Data

Part 2 of the Main Menu allows the user to perform three important steps while running the model. First, the information that has been selected in all previous menus is read into the model to the calculation of visits and benefits for a baseline run. Second, if calibration is needed to make predicted visits conform to observed visits it may be implemented at this time with use of the calibration factors menu. Third, after calculation of the baseline visitation and benefits is completed, the user continues to the Implement Management Changes Menu to make changes that reflect any new management actions to be evaluated.

Read Data, Calibrate, Compute Baseline Visitation/Benefits Menu (2.1)

This part of the main menu allows the model to read the data defined or read earlier and compute resulting baseline visitation and benefits. After the model sorts the data, the data will be placed in temporary files to protect the permanent files from damage. All data previously defined pass through this point whether reading a previously saved file, calling up data for an existing project in the database, or defining a new project electronically.

Calibration Option

The user may calibrate the model so it predicts visitation consistent with more recently observed visitation. Because the model was estimated using 1983-86 visitation data, this option is particularly valuable when running the model for years into the 1990s and beyond. The calibration option menu is not numbered on the flowchart, but it appears between boxes 2.1 and 2.2. This menu comes up on the screen while files are being processed and before any baseline visits or benefits are calculated. You will be prompted "DO YOU WISH TO CALIBRATE THE MODEL?". Select "YES" or "NO" using

the arrow keys and press RETURN. Calibrating the model requires selecting calibration factors for every project you wish to analyze, one project at a time.

Calibration is accomplished by running the model first. For example, if the model predicts only one half of total observed visits to the project, enter 2.0 into the calibration field for the chosen reservoir. This data entry multiplies predicted visits by 2.0 to elevate the model's visitation prediction consistent with observed data. Once implemented, the calibration applies a shift in predicted visitation and benefits internally for a complete model session.

The need for calibrating a model that predicts visitation results from the model failing to predict visits perfectly. The model is expected to predict more poorly as applications are required further into the future from the 1983-86 period for which the model was estimated.

To reduce the need for extensive calibration, it is advised that the user acquire the most recent data for use with the model. Existing data in the databases can be changed from baseline (1985) levels to those that reflect the most current conditions for both the reservoir facilities and demographic variables. For details on performing this procedure, see Chapter 8. Once calibrated, all further management actions are based on the model adjusted to correctly predict actual visitation behavior. Calibration changes are saved using menu 2.4.[1]

After reading data, calibrating, and computing baseline[2] visitation and benefits (box 2.1), proceed to the Changes Menu 2.4 using 2.2 (Figure 1) to implement management actions.[3]

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[1] To run the model with uploaded data (Option 1.1 Part 1 Main Menu), proceed in the same manner as described above to calibrate or compute visitation and benefits for the baseline. Selecting to Upload Baseline Data 1.1 requires only selecting a file to upload. Neither Geographic Scope Menus 1.3.1 through 1.3.4 nor Defining Menus 1.2.1 through 1.2.4 are required because all information is saved within the uploaded file and is ready for use by the model.

[2] After selecting Menu 2.1 the status of the model is shown on the screen as it processes data. The model may pause at this point. The model is performing various checks and will take a few moments. When the message "COMPUTING VISITATION" appears at the top of the screen, track the program's progress by watching the counter at the bottom center of the screen. Two numbers are displayed separated by a "/". The first number counts the current iteration and the second indicates how many total iterations need to be performed.

[3] WARNING. Do not type anything while the computer is performing calculations. Only when all calculations are completed and the counter has stopped will the option 2.2 be highlighted to proceed. Place the highlighted bar on selection 2.2 (Go to Changes Menu) to proceed.

8 Implement Management Changes (2.4)

In this menu (box 2.4) enter values of any variables that reflect proposed management action. This menu allows the user to change any variable that affects visitation and benefits for the reservoir(s) defined. A discussion for each option in this menu follows.

Make Changes to Project Facilities and Fees (2.4.1)

The user may change any or all project variables including fees for day use and camping use. A screen is displayed that shows all the reservoir facilities and fees that can be changed. To change any value, TAB to the location under the title of the attribute and type in the new number followed by a RETURN. The user can move around the screen using SHIFT-TAB to move back, TAB to move forward, and the arrow keys to move the cursor up and down. Place the cursor over any field to be changed. When changes are completed, type the CTRL-END keys together to save project information.

Make Changes to Zone Demographics (2.4.2)

The user may change any or all visitor county demographic variables by selecting "Change Zone Variable" from the menu. Changes is zone demographics are made in the same manner as that for project facility data. When finished, type CTRL-END to save changes and return again to the Implement Management Changes Menu.[1]

[1] After you look at or change project and zone variables you may go back to them from the menu and redo any or all changes you have made. To do so, select the Redo option under either project or zone and press ENTER. Any changes are saved with CTRL-END.

Save Changes to a File (2.4.3)

This option has two important uses. It allows the user to save baseline data so they may be used again in a future session without re-entering the data. It also allows management changes to zone and project facility data to be saved so as not to have to re-enter data in future sessions.

First, when entering the Implement Management Changes Menu, a user may save information regarding baseline calibration and all data for later use. If the user calibrates the model, all calibration factors are saved with the file information. This option is important if the user spends considerable time defining a non-study site.

Second, after making management changes to project and zone variables, the changes can be changed again to a file to upload the saved information during a later session. Note that baseline data must be saved before changing them or data will be lost when changes are made.

To save a file, select the Save option and enter the name under which to save the data. A menu asks for the information to save the file (menu 2.6). There is no need for an extension. Names of eight or less characters are required. The file is saved to the path "\RRDM\WORK\filename." Do not enter a path for the file destination because the program has been written to save the file in WORK directory only.

Upload a File With Saved Changes (2.4.4)

A file saved from a previous session may be uploaded for use in the current session. After selecting this option the user is shown a list of available files to upload. Choose the one to be used. The file is copied from the WORK directory into the current work space. The user may view and change this file if needed by using the change or redo options for either zone or projects variables. All previous changes apply to the current model session.

Compute Visitation/Benefits With Management Changes (2.4.5)

After all variables are defined to reflect desired management actions, compute visitation data using the changes or uploaded files. While the model is calculating visitation and benefits watch the counter at the bottom of the screen for progress. Calculations are completed only when the counter has stopped. Results can then be sent to a chosen peripheral device.

9 Send Output Menu (2.5)

After computing visitation and benefits data, the Send Output Menu (box 2.5) issues a prompt for the place to send output data. If selecting a file, the user is asked for a file name (box 2.6). Enter the drive letter and path preceding the name of the file to save results. No extension is needed.

"To the Screen" sends the results to the screen only. All information is scrolled by on the computer screen. Only short results should be sent to the screen. It is a good option for saving paper if the results of the model run are not needed or a mistake was made. If a mistake was made, send results to the screen and start a new model run.

"To a Printer" sends results to the local printer if it is ready. Make sure the printer is ready and connected. There is a blank page between camping and day use visitation reports when printed.

"To a File" sends results to a location defined for later viewing. This is the most paper-conserving method of viewing results. The program asks for a path to which to send the file (box 2.6). Type in the drive letter and then the path (e.g., A:results). The file is saved as a text file (.TXT) and can be brought up into most word processing programs for subsequent viewing.

Title Menu (2.7)

The user may enter a title for output if desired (box 2.7). Enter the title that will appear at the top of each page of output. The title appears at the top center of every page sent to the output device. To suppress the title, press ENTER without typing any characters and the program will leave this blank. The title can be up to 125 characters in length including spaces.

Report Generation Menu (2.8)

Upon completion of the title menu, the user is prompted for "Summary Report Only" (box 2.8). To view individual visits and benefits data for each origin county as well as totals for each project, select NO. Selection of this

option generates only total visits and benefits by project. The report suppresses individual zones of origin associated with the selected reservoirs. The reports contain the following items:

a. First, each results page has the time and date at the upper left corner of the first sheet. The time and date help keep track of multiple model runs.

b. Next, the title is displayed at the top center of the first page of each report. Under the title is the report type, either Day Visitation or Camping Visits.

c. Third, the top of the first column lists "Site" and the reservoir name. Following the reservoir name is a list of all origin zones within the market area. They are in the form CITY NAME and STATE abbreviation (e.g., HAYFORK CA).

d. Fourth, are baseline annual visits and benefits. They appear in the second column. The total for both visits and benefits for each reservoir is listed at the bottom of each column followed by average benefits per visit. Benefits per visit is the ratio of total benefits to total visits after first summing each over all zones of origin.

e. Next, are post-changes visits and benefits. They appear in the third column. The total for both visits and benefits for each reservoir is listed at the bottom of each column followed again by the average benefits per visit.

f. Sixth, the final column is the change that resulted as a direct consequence of the management actions. This change is listed for every origin city associated with a particular reservoir. The total change from all cities is listed at the bottom of the column.

After the output has been sent to the selected destination, the model returns again to Part 3 of the main menu to either restart another RRDM session or quit the model.

10 An Example Run

This chapter illustrates an actual model run. It assumes familiarity with the previous chapters on flow of the menus and operation of the model.

One important use of RRDM is to economically evaluate management actions implemented at projects not presently in the model's data files. The user builds a project and evaluates the recreation economics electronically.[1]

A series of model runs on Clearwater Lake in southeastern Missouri is illustrated. Model runs were made to evaluate the effect of raising the permanent recreation pool to several potential levels, compared to current operating standards. These management actions are presently (1994) under consideration by the USACE Little Rock District.

Define Facilities at Clearwater Lake (Menu 1.2.1)

Reservoir facility data are available from the USACE Natural Resource Management System (NRMS) data storage system. Variables needed are listed in Appendix B. If unable to find a variable, its average value for the Sacramento, Little Rock, and Nashville Districts appears as a default in parentheses to the right of the prompt. Enter this value until better information is available.

Most information for Clearwater Lake comes from 1991 NRMS data. This information is entered into the model by typing values in each field from the user interface screen. After all information is entered, it is saved using CTRL-END. The user is ready to define zone-of-origin demographic data.

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[1] Before beginning, make sure to acquire all information on the geographic location regarding the model run. Define a reservoir and origin counties as soon as all the required information is available before beginning a session. All the variables in Appendix B and their values are needed by the program to produce results. These are the variables found to most significantly affect visitation at large recreational reservoirs.

Define All Origin Counties Within the Market Area (Menu 1.2.2)

Entering these data requires information on the demographic characteristics of all counties within 175 miles of Clearwater Lake. In later versions of the RRDM software this distance may be modified to include varying market areas.

The following steps may be helpful to acquire data on the counties. It will help to compile an organized list of counties and variables to make the data entry easiest.

First, locate the target reservoir using a high resolution map of the market area. Second, draw a circle around the lake with a radius of 175 miles. This circle represents the market area. Third, locate each county in the circle and its largest city. The largest city in each county is used to represent the location of the county's entire population. Fourth, using a source of demographic data (e.g., U.S. Census) look up the value of each demographic variable listed in Appendix B[1] for each city found. Attempt to locate and use the most recent data available. The older the data that are used, the more limited in the accuracy of predicted visitation and benefits the model will be.

One hundred thirty counties were located for the 175-mile market area around Clearwater Lake using the 1993 Rand McNally Road Atlas. After all the demographic information is collected, it is entered into the model through the interface screen. When entering the data and saving it are completed, proceed to the variable travel cost menu.

Set Variable Travel Cost Per Mile (Menu 1.2.3)

The travel cost is left at the default setting for the Clearwater run. As long as travel costs for all runs for Clearwater Lake remain constant, any changes resulting from management action can be attributed to that action. If travel cost needs to be changed, the new value should be entered and saved. Proceed to the next menu to set travel distances.

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[1] Some variables such as "Sub_Inx," the substitute index, and "Ocean," the distance to nearest ocean or Great Lake, are not in census sources. For Sub_Inx, the index of substitute reservoir opportunities, you approximate using the default values shown on the screen for the value. A better estimate is found by looking up the value of Sub_Inx for a zone-of-origin in the database with similar water substitute opportunities. For "Ocean" use a map or other source.

Set Travel Distance from Every Origin County (Menu 1.2.4)

A one-way travel distance is required for every origin county entered. Several commercial versions of travel distance computing software are available, such as PCMiler©. Ordinarily, practical driving distances from a reservoir to a county's largest city can be used directly from a map. The travel time required to drive each distance entered is automatically calculated by the model as a proportion of distance and saved with the other information. Travel time does not need to be entered.

The definition of the target reservoir and associated counties is complete after all distances are entered and saved. The model is then run using the entered information. However, before running the model without management actions, the user must pass through the "Set Geographic Scope Menu" as shown in Figure 1.

Set Geographic Scope (Menus 1.3.1 Through 1.3.4)

As discussed previously, the geographic scope of the Clearwater Lake run is set as if the user had read an already existing database for a project. For the Clearwater Lake run the following selections are made. First, from menu 1.3.1 the "One Project" is selected since there is only one project defined. Second, from menu 1.3.3 "Clearwater" is selected from the list of projects. Third, from menu 1.3.4 the "Pooled Equation" option is selected. The District-specific Little Rock Equation could also be used if desired.

Calculate Baseline Data (Main Menu Part 2:2.1)

After setting geographic scope, the user is returned to the Main Menu Part 2. At this point, baseline visitation and benefits are calculated. Selecting 2.1 from the menu begins the baseline calculations. The baseline is calculated with no calibration to the model.[1] When the calculation counter has stopped and calculations are complete, option 2.2 is selected to go to the Changes Menu.

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[1] Calibration is done after the initial run. The calibration factor is figured from the ratio of model-predicted visits to observed visits.

Changes Menu (2.2)

Changes regarding management actions are put into place from this menu. By viewing and changing information, the user can implement management actions. The use of the Changes Menu (2.2) options for the Clearwater scenario are performed as follows.

Save the Defined Project to a File (Menu 2.4.4)

The data entered to this point are saved so no information is lost. This step saves the information to the hard drive for later uploading and use again for proposed management actions should the user wish to do so. To save the data the Clearwater file does not have to be re-entered for future model runs.

Increase Recreational Pool Surface Area (Menu 2.4)

Table 3 shows a baseline reservoir elevation and four alternative management actions presently under consideration by the Little Rock District (1994). The user is now ready to estimate the economic consequences of increasing water levels by the various amounts.

Table 3
Potential Reservoir Recreation Pools at Clearwater Reservoir

Action Taken	Elevation ft	Added Elevation ft	Surface acres	Added Surface acres
Baseline: No action	494	0	1630	0
Action 1	508	14	2730	1100
Action 2	514	20	3330	1700
Action 3	519	25	3850	2220
Action 4	529	35	4900	3270

The first management action is implemented by modifying the baseline data to reflect the increase in surface acres from 1630 acres to 2730 acres (494 to 508 ft elevation). The SUR_AC variable that represents surface acres is located in the Change Project Facilities and Fees option from menu 2.4.1. The default value of 1630 is changed by placing the cursor over the value and typing 2730 and pressing ENTER. After this change is made and saved, the model is run by selecting the Compute Visitation/Benefits option in menu 2.4.

Produce Output (Menus 2.5 Through 2.8)

From the output options available in the Send Output Menu 2.5, the FILE option is selected. This selection sends the output directly to a file for later viewing. The file name given to the results file is "CLEAR1.txt" in case the user wishes to look at it. Results are shown in Appendix D. After creating the output file, the model returns to the main menu.

Results Without Model Calibration

Computed visitation (Appendix D) to Clearwater Lake for both camping and day use is considerably lower than observed visitation. Results are shown in Table 4 for comparison.

Table 4
Results of RRDM Run With and Without Calibration

Day Use		Camping	
Predicted	Observed (1993)	Predicted	Observed (1993)
128,300	1,088,100	23,400	74,100
Calibration Factor = 8,481		Calibration Factor = 3,167	

Results With Model Calibration

Calibrating the model adjusts model-predicted visitation to coincide with observed visitation at a reservoir. For detailed procedures for calibrating the model, refer to Calibration Option in Chapter 7.

To determine if calibration is needed for the Clearwater Lake run, the model is run with calibration factor values at default values (1.0). Next the visitation results predicted by the model are compared with actual visitation data for camping and day use from Clearwater Lake. The ratio of model-predicted visits to observed visits is calculated. For the Clearwater Lake run, the ratio of observed to predicted visits is 16.0. Table 4 contains data that are used to calculate the calibration factor.

It is necessary to calibrate the model run because it underpredicts by a factor of 8.48 for day use and 3.16 for camping. The calibration factor is set to 8.48 for day use and 3.17 for camping. To calibrate visitation with the new calibration factor, go back through the model and change the default value from 1.0 to 8.48 and 3.17 for day use and camping, respectively, by performing the following steps.

From the main menu part 3 "RESTART" is selected. This clears information from the previous run and readies the model for the new run. Next the file CLEAR1 is uploaded for a new model run. After the file is uploaded, 2.1 from part 2 of the main menu is selected. When asked if calibration is needed, YES is selected. This inflates the computed visits by 8.48 and 3.16 times for day use and camping, respectively, consistent with observed data. With the calibration factors reset to the new values, go on to implement the changes in management actions.

Go to Changes Menu (2.2)

With the model calibrated, option 2.2 is selected to go to the changes menu. First, using option 2.4.3 save the calibrated data baseline data to a file. The Clearwater run is saved to CLRCAL. Second, using option 2.4.1 change the water level to reflect the first action. The surface acres are raised to action 1 (Table 3). Third, using option 2.4.4 compute visitation. After visitation is computed and output generated, visitation is observed for the run. Results are summarized in Table 5 and full reports are given in Appendix D.

The calibration steps above cause predicted visitation for both camping and day use to match actual observed data for the reservoir. The remaining water increases in the schedule were performed in a manner similar to that for the calibrated baseline run. For each action (2-4) the same steps are taken. Restart each run and upload the CLRCAL file for use from the main menu to calculate the baseline visitation. Go to the changes menu and implement the next management action by changing surface acres to the next level on the schedule. Finally, run the model with this new management action in place to calculate the resulting visitation and benefits.

When implementing management action, two steps from the baseline are omitted. First, calibration need not be performed in subsequent runs since this information is saved after the baseline is calibrated. Every time the model is run for a new action, the calibrated model is uploaded to compute baseline visitation. Since the information is saved in the file that is uploaded for each run, every new potential surface acre increase (2-4) is examined with the calibrated model. There is no need to recalibrate for each new run. Second, from the changes menu 2.4 saving the file is not necessary because the baseline data are identical for every run after the calibration is performed; water level is not changing for baseline visitation and benefits. The only thing that changes from one run to the next occurs after baseline visitation and benefits have been calculated.[1] Results are as expected, and each is given in Appendix C. Increased levels increase visits and benefits for both camping and day use. Results are shown in Table 5.

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[1] Baseline visits are identical for each run. The resulting visitation from each action will vary according to the magnitude of the action taken. See Appendix D for these comparisons.

Table 5
Results With Calibration: Day Use and Overnight Visitation Resulting from Management Actions

Action Taken	Type of Visitation	Total Benefits (1980 $)	Benefits/Visit (1980 $)	Gain in Visits	Gain in Benefits (1980 $)
Baseline	Camping	547,600	7.39	--	--
	Day use	1,686,600	1.55	--	--
Action 1: Raise to 2,730 Surface Acres	Camping	632,600	7.39	+ 11,500	+ 85,000
	Day use	1,782,200	1.55	+ 61,700	+ 95,600
Action 2: Raise to 3,330 Surface Acres	Camping	668,800	7.39	+ 16,400	+ 121,200
	Day use	1,820,500	1.55	+ 86,400	+ 133,900
Action 3: Raise to 3,850 Surface Acres	Camping	696,900	7.39	+ 20,200	+ 149,300
	Day use	1,849,000	1.55	+ 104,800	+ 162,400
Action 4: Raise to 4,900 Surface Acres	Camping	745,700	7.39	+ 26,800	+ 198,100
	Day use	1,897,200	1.55	+ 135,900	+ 210,600

Results of the Clearwater Lake run show that as the surface acres increase from the baseline level of zero to each new level (actions 1-4), both camping and day use visitations increase. The model also shows that the resulting benefits for each action increased as visits increased for both day use and camping.

Results of the Clearwater run are consistent with prior expectations. As surface acres at the lake increased, the recreational quality of the lake increased, making it more attractive to both campers and day users. As a result visitors desired more recreation at Clearwater Lake and visited it more often. The increased visitation caused greater benefits to accrue from each management action taken.

The Clearwater Lake results in conjunction with data on costs of each action allow the comparison of resulting benefits[1] and the costs to determine

[1] Benefits are measured in 1980 dollars. These values can be adjusted by using the consumer price index for any given year. Benefits in 1980 dollars must be multiplied by 1.7 to show benefits in 1994 dollars.

whether it is economically efficient to implement the proposed action for Clearwater Lake. If analysis shows benefits outweigh costs for all actions, RRDM will help in determining which management action would be the most economically efficient. Updating the benefits to 1993 values (latest year available) produces benefit estimates shown in Table 6.

Table 6
Updated 1993 Estimates of Day Use and Camping Benefits

Action Taken	Type of Visitation	Total Benefits (1993 $)	Benefits/Visit (1993 $)	Gain in Visits	Gain in Benefits (1993 $)
Baseline	Camping	873,200	11.79	–	–
	Day use	2,687,600	2.47	–	–
Action 1: Raise to 2,730 Surface Acres	Camping	1,008,800	11.79	+ 11,500	+ 135,600
	Day use	2,840,000	2.47	+ 61,700	+ 152,400
Action 2: Raise to 3,330 Surface Acres	Camping	1,066,600	11.79	+ 16,400	+ 193,400
	Day use	2,901,000	2.47	+ 86,400	+ 213,400
Action 3: Raise to 3,850 Surface Acres	Camping	1,111,400	11.79	+ 20,200	+ 238,200
	Day use	2,946,500	2.47	+ 104,800	+ 258,900
Action 4: Raise to 4,900 Surface Acres	Camping	1,189,200	11.79	+ 26,800	+ 316,000
	Day use	3,023,300	2.47	+ 135,900	+ 335,700

11 Conclusions

The need to perform economic analyses of natural resource management plans continues to grow. Increasingly, the Congress, various special interest groups, and the general public demand economic performance as a basis for implementing natural resources management plans.

Users of the RRDM software described herein need not be trained in economic analysis methods. Through the use of user-friendly computer screens the model allows selection of important information required to predict the economic consequences of a management action.

By using computer screens the user may also define a project that does not exist in the RRDM data set. This creation of an electronic data set allows a wider scope for use of the model across many reservoirs and lakes.

The development of user-friendly software to support natural resource management decisions is in its infancy. Computer models have had limited use in progressive resource agencies for a number of years. However, these models are often not utilized at their full potential due to their clumsiness and inefficient operation procedures. When using these models, the user is often required to assume the role of biologist, hydrologist, economist, and computer scientist. The level of familiarity in each subject places much of the responsibility for performing analyses upon the user rather than the tool.

It is hoped that the RRDM described in this report will contribute to greater efficiency in the formulation, implementation, and evaluation of economically wise decisions.

Appendix A
Mathematical Documentation of Regional Recreation Demand Model

This appendix documents the indices, parameters, variables, and equations used to estimate the RRDM and to evaluate impact of reservoir management action.

Table A1
Indices

Index	Name of Index	Assigned Members		
i	County of Origin	893 total counties surrounding the projects listed below		
j	Corps Project	Barkley (N)	Beaver (L)	Black Butte (S)
		Blue Mtn (L)	Bull Shoals (L)	Center Hill (N)
		Cheatham (N)	Cordel Hull (N)	Cumberland (N)
		Dale Hollow (N)	Dardanelle (L)	Eastman (S)
		Englebright (S)	Hensley (S)	Isabella (S)
		J.P. Priest (N)	Kaweah (S)	Laurel River Lake (N)
		Mendocino (S)	Millwood (L)	New Hogan (S)
		Nimrod (L)	Norfolk (L)	Pine Flat (S)
		Success (S)	Table Rock (L)	
h	Zone Variable Indicator	Appendix B includes all variables that vary by county of origin		
k	Project Facility Indicator	Appendix B includes all 19 facility indicators		

Note: S = Sacramento District, L = Little Rock District, N = Nashville District.

Table A2
Parameters

Variable No.	Variable Description	Sacramento Model		Little Rock Model		Nashville Model		Pooled Model	
		Day	Camping	Day	Camping	Day	Camping	Day	Camping
	β_k = Parameter Estimate for k^{th} Project Facility								
(1)	Percent full in surface acres	5.43 (7.38)	2.45 (4.80)[2]	--[1]	--	--	--	4.25 (8.47)	--
(2)	Coefficient of variation on water surface area	-0.34 (-2.67)	-0.27 (-2.60)	--	-0.57 (-6.58)	-0.35 (-2.92)	-0.65 (7.51)	-0.01 (1.64)	-0.63 (-12.12)
(3)	Water surface acres	0.30 (5.83)	0.96 (1.80)	0.13 (8.73)	0.14 (3.92)	0.28 (23.01)	0.35 (21.38)	0.38 (17.82)	0.34 (15.02)
(4)	Miles of shoreline	--	--	--	--	--	--	-0.47 (-10.33)	-0.43 (-12.61)
(5)	Morphoedaphic index	0.76 (3.49)	1.29 (3.55)	--	--	0.50 (8.48)	0.60 (13.99)	0.33 (6.01)	0.60 (11.81)
(6)	Total dissolved solids	--	-1.11 (-3.28)	--	--	--	--	--	-0.70 (-9.06)
(7)	# Game fish species	--	--	0.41 (1.81)	--	--	--	0.40 (2.53)	0.98 (6.76)
(8)	#Picnic tables	0.17 (3.80)	--	0.09 (5.96)	--	0.18 (23.48)	--	0.12 (10.91)	--
(9)	# Campsites	--	0.17 (3.41)	--	0.09 (3.31)	--	0.18 (13.81)	--	0.18 (11.49)
(10)	# Parking spots	0.26 (4.29)	--	0.18 (9.27)	--	0.16 (23.46)	--	0.23 (17.51)	--
(11)	# Boat lanes	0.74 (8.65)	0.38 (4.21)	0.10 (6.78)	0.02 (1.27)	0.13 (23.14)	0.34 (22.06)	0.20 (18.39)	0.29 (15.33)
(12)	# Beaches	0.29 (3.51)	0.035 (3.99)	0.08 (5.79)	0.03 (2.21)	0.15 (15.35)	0.10 (8.35)	0.14 (11.61)	0.10 (7.25)
(13)	# Marinas	0.70 (5.25)	0.90 (6.20)	0.16 (9.48)	0.06 (2.18)	0.28 (19.51)	0.35 (19.11)	0.41 (15.52)	0.39 (15.34)
(14)	# Private boat docks	--	--	--	0.03 (2.57)	0.03 (7.52)	0.02 (4.60)	0.01 (2.80)	--

(Continued)

[1] Indicates a parameter estimate of zero.
[2] Student's t-values are in parentheses.

Table A2 (Concluded)

Variable No.	Variable Description	Sacramento Model		Little Rock Model		Nashville Model		Pooled Model	
		Day	Camping	Day	Camping	Day	Camping	Day	Camping
	β_h = Parameter Estimate for h^{th} Zone Variable								
(1)	Population	0.94 (10.51)	0.97 (13.40)	1.17 (9.99)	0.86 (8.99)	0.50 (9.57)	0.36 (10.54)	0.73 (18.31)	0.61 (17.58)
(2)	Per capita income	0.94 (1.64)	0.56 (1.20)	1.31 (2.18)	--	1.76 (7.92)	0.54 (3.36)	1.36 (5.28)	0.29 (1.64)
(3)	Unemploy-ment rate	--	--	--	-0.86 (-2.92)	--	--	-0.34 (2.20)	--
(4)	Percent black and hispanic	--	--	--	--	-0.11 (-2.55)	-0.06 (-2.08)	-0.13 (-3.39)	--
(5)	Proportion of population under 18	--	--	1.18 (2.06)	--	--	--	--	--
(6)	Index of substitute surface acres	-1.28 (-2.68)	-1.31 (-3.33)	-2.38 (-5.60)	-0.11 (-0.24)	-1.28 (-7.30)	-0.66 (-5.40)	-1.34 (9.63)	-1.10 (-10.17)
(7)	Proportion of population over 65	--	--	--	--	-0.42 (-2.37)	--	--	--
(8)	Miles to nearest ocean	--	--	--	-3.68 (8.36)	1.63 (5.77)	--	--	--
	βp = Parameter Estimate for Price (travel cost) Per Visit								
(1)	Price per visit	-4.10 (-20.45)	-3.03 (-18.57)	-3.25 (21.29)	-2.27 (-15.51)	-1.75 (-26.27)	-0.67 (-14.25)	-2.35 (36.8)	-1.26 (-22.56)
	β_o = Parameter Estimate for Intercept Term								
(1)	Intercept value	-24.41 (-3.42)	-2.61 (-0.41)	3.88 (0.68)	25.89 (3.67)	-14.80 (-5.22)	-2.71 (-1.54)	-24.14 (6.77)	6.52 (3.38)
	γ_j = Calibration Parameter for j^{th} Project (default of 1.0 for all models unless changed) Used to Set Model-Predicted Visits to Equal Observed Visits								
(1)	Calibration factor (DEFAULT)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Table A3
Variables

Variable Name	Variable Description
V_{ij}^{Camp}	Predicted annual visits by campers from county i to site j
V_{ij}^{Day}	Predicted annual visits by day users from county i to site j
F_{jk}	Value at the j^{th} project taken on by the k^{th} facility variable. See list of parameters β_k for order in which facility variables are defined
Z_{ih}	Value at the i^{th} county taken on by the h^{th} zone variable. See list of parameters β_h for order in which facility variables are defined
P_{ij}^{Camp}	Travel cost (price) variable including round-trip travel costs from the i^{th} county to the j^{th} project, overnight visitors
P_{ij}^{Day}	Travel cost (price) variable including round-trip travel costs from the i^{th} county to the j^{th} project, day use visitors
$Pmax_j^{Camp}$	Travel cost from edge of market area to j^{th} project, overnight visitors
$Pmax_j^{Day}$	Travel cost from edge of market area to j^{th} project, day use visitors
CS_{ij}^{Camp}	Total consumer surplus (benefits) from the i^{th} county to the j^{th} project, overnight visitors
CS_{ij}^{Day}	Total consumer surplus (benefits) from the i^{th} county to the j^{th} project, day use visitors
CST_j^{Camp}	Total consumer surplus (benefits) from all counties to the j^{th} project, overnight visitors
CST_j^{Day}	Total consumer surplus (benefits) from all counties to the j^{th} project, day use visitors
CSP_j^{Camp}	Average benefit per visit to project j from all counties, overnight visitors
CSP_j^{Day}	Average benefit per visit to project j from all counties, day use visitors

Equations

$$V_{ij}^{Camp} = \gamma_j \beta_o^{Camp} P_{ij}^{Camp^{\beta_p}} \prod_k F_{jk}^{\beta_k} \prod_h Z_{ih}^{\beta_h} \quad (1)$$

$$V_{ij}^{Day} = \gamma_j \beta_o^{Day} P_{ij}^{Day^{\beta_p}} \prod_k F_{jk}^{\beta_k} \prod_h Z_{ih}^{\beta_h} \quad (2)$$

$$CS_{ij}^{Camp} = \int_{P_{ij}^{Camp}}^{Pmax_j^{Camp}} V_{ij}^{Camp} = \frac{V_{ij}^{Camp}}{(1 + \beta_p) P_{ij}^{\beta_p}} \left[Pmax_j^{(1+\beta_p)} - P_{ij}^{(1+\beta_p)} \right] \quad (3)$$

$$CS_{ij}^{Day} = \int_{P_{ij}^{Day}}^{Pmax_j^{Day}} V_{ij}^{Day} = \frac{V_{ij}^{Day}}{(1 + \beta_p) P_{ij}^{\beta_p}} \left[Pmax_j^{(1 + \beta_p)} - P_{ij}^{(1 + \beta_p)} \right] \quad (4)$$

$$CST_j^{Camp} = \sum_i CS_{ij}^{Camp} \quad (5)$$

$$CST_j^{Day} = \sum_i CS_{ij}^{Day} \quad (6)$$

$$CSP_j^{Camp} = \frac{\sum_i CS_{ij}^{Camp}}{\sum_i V_{ij}^{Camp}} \quad (7)$$

$$CSP_{jp}^{Day} = \frac{\sum_i CS_{ij}^{Day}}{\sum_i V_{ij}^{Day}} \quad (8)$$

Appendix B
Variables in Model

Demographic Variables in Model

This appendix shows the names used in Definition Screen (1.2.1 and 1.2.2) and equivalent terms used in Changes Menus (2.4.1 and 2.4.2).

Name Used in Zone Definition Screen (1.2.2)	Name Used in Management Changes Menu (2.4.1)	Shown on Screen
POPULATION	PEOPLE	Yes
PER CAPITA INCOME	INCOME	Yes
WAGE RATE	WAGES	Yes
UNEMPLOYMENT	NO_WORK	Yes
PROPORTION BLACK	BLACK	Yes
PROPORTION HISPANIC	HISPANIC	Yes
AVERAGE AGE OF POPULATION	MED_AGE	Yes
SUB_INX	SUB_INX	Yes
PROPORTION UNDER 18	UNDER_18	Yes
PROPORTION OVER 65	OVER_65	Yes
DISTANCE TO THE OCEAN	OCEAN	Yes

Project Facility Variables in Model

Name Used in Project Definition Screen (1.2.1)	Names Used in Management Changes Menu (2.4)	Shown on Screen
SURFACE ACRES	SUR_AC	Yes
AVERAGE DEPTH	DEPTH	Yes
MILES OF SHORELINE	SHORE	Yes
NUMBER OF PARKING SPOTS	PARKING	Yes
NUMBER OF CAMPING SPOTS	CAMPS	Yes
NUMBER OF PICNIC SITES	PICNIC	Yes
NUMBER OF BOAT LANES	LANES	Yes
NUMBER OF BEACHES	BEACHES	Yes
NUMBER OF MARINAS	MARINAS	Yes
NUMBER OF BOAT DOCKS	DOCKS	Yes
NUMBER OF GAME FISH SPECIES	SPECIES	Yes
TOTAL DISSOLVED SOLIDS	TDS	Yes
WATER VISIBILITY	SECCHI	No
CARLOAD	CAR_LOAD	No
PERCENT	PERCENT	No
ACRES	ACRES	Yes
DAY FEE	DFEE	Yes
CAMPING FEE	CFEE	Yes
COEFFICIENT OF VARIATION	CV	Yes

Appendix C
Variable Descriptions

This appendix provides a complete description of all the variables in the RRDM including the county or project index over which it varies.

Variable Name	Variable Description
$POPULATION_i$	The population of county i, taken from the 1980 census
$UNEMPLOYMENT_i$	The percentage unemployment rate of county i from the 1980 census
$INCOME_i$	The average annual income in county i from the 1980 census
$UNDER\_18_i$	The percent of people in county i under the age of 18, taken from the 1980 census
$OVER\_65_i$	The percent of people in county i over the age of 65, taken from the 1980 census
$MEDIAN\_AGE_i$	The median age in county i from the 1980 census
$WAGE\_RATE_i$	The per capita wage rate of those in the work force in county i from the 1980 census, used to compute the cost to visitors of travel time
$BLACK_i$	The percentage of black people in county i from the 1980 census
$HISPANIC_i$	The percentage of Hispanic people in county i from the 1980 census

$PICNIC_j$	The number of day use picnic tables at site j
$PARKING_j$	The number of parking spaces at site j (sum of car and trailer spaces)
$LANES_j$	The number of boat launch lanes at site j
$BEACHES_j$	The number of swimming beaches at site j
$CAMPS_j$	The number of camping sites at site j
$MARINAS_j$	The number of full-service marinas at site j
$DOCKS_j$	The number of private boat docks at site j
$SPECIES_j$	The number of game fish species existing in reservoir j
MEI_j	The morphoedaphic index of reservoir j. Used to indicate trophic state and potential for fish production of a reservoir. It is equal to total dissolved solids divided by average depth.
$SECCHI_j$	The average depth (in feet) of all Secchi disk readings at reservoir j
SUR_AC_j	The surface acres of site j at the recreation pool level
CV_j	The coefficient of variation for monthly average surface acres of site j during the recreation season
$SHORE_j$	The recreation pool shore miles of site j
$COST_{ij}$	The total per-visitor round-trip travel cost (travel plus time plus fees) from county i to site j
SUB_INX_i	The substitute index of alternative lake or reservoir recreation opportunities for county i
$OCEAN_i$	The one-way distance from county i to the nearest ocean or Great Lake recreation site

Appendix D
Output of Clearwater Lake Management Actions

CLEARWATER LAKE RESULTS

Raise surface acres to 2730

Date: 07/14/94 LITTLEROCK Equation
Time: 13:23:32

RESULTS ARE DISPLAYED AS CAMP VISITS AND BENEFITS PER YEAR

Origin	BASELINE		Post-Change		Difference	
	# Visits	Benefits	# Visits	Benefits	# Visits	Benefits
Site: CLEARWATER						
CAIRO IL	733	2926	788	3145	55	219
POPLAR BLUFF MO	5667	12332	6091	13255	424	923
CAPE GIRARDEA MO	7862	28002	8450	30097	588	2096
JONESBORO AR	2464	10993	2648	11816	184	823
AVA MO	235	1171	252	1258	18	88
SALEM AR	630	1854	677	1992	47	139
PARAGOULD AR	1435	5580	1542	5997	107	418
WEST PLAINS MO	1138	3901	1223	4193	85	292
IRONTON MO	3607	7587	3877	8154	270	568
WISEMAN AR	40	421	43	453	3	32
CARBONDALE IL	5203	23846	5593	25631	389	1785
WALNUT RIDGE AR	818	3135	879	3369	61	235
PORTAGEVILLE MO	1168	4598	1255	4942	87	344
THAYER MO	693	2220	745	2386	52	166
GAINESVILLE MO	161	763	173	820	12	57
PERRYVILLE AR	402	1366	432	1468	30	102
ROLLA MO	2361	9294	2537	9990	177	696
MOUNDS IL	612	2648	657	2846	46	198
CHESTER IL	3799	14496	4083	15581	284	1085
POCAHONTAS AR	791	2604	851	2799	59	195
ELLINGTON MO	4946	6082	5316	6537	370	455
DONIPHAN MO	1251	2837	1344	3050	94	212
SIKESTON MO	3421	12212	3677	13126	256	914
WINONA MO	1506	3125	1619	3359	113	234
CAVE CITY AR	294	1341	316	1442	22	100
HOUSTON MO	1422	4818	1529	5179	106	361
ANNA IL	1514	6553	1627	7044	113	490
Total	54171	176705	58225	189929	4054	13224
Per Visit		3.26		3.26		3.26

Raise surface acres to 2730

Date: 07/14/94 LITTLEROCK Equation
Time: 13:23:37

RESULTS ARE DISPLAYED AS DAY VISITS AND BENEFITS PER YEAR

Origin	BASELINE # Visits	Benefits	Post-Change # Visits	Benefits	Difference # Visits	Benefits
Site: CLEARWATER						
CAIRO IL	8289	18729	8866	20033	577	1303
POPLAR BLUFF MO	185089	227952	197968	243814	12879	15862
CAPE GIRARDEA MO	108639	219112	116199	234359	7560	15247
JONESBORO AR	28560	72183	30547	77206	1987	5023
AVA MO	2363	6676	2528	7141	164	465
SALEM AR	9008	15013	9635	16057	627	1045
PARAGOULD AR	19054	41964	20380	44884	1326	2920
WEST PLAINS MO	29732	57719	31800	61735	2069	4016
IRONTON MO	56779	67588	60730	72292	3951	4703
WISEMAN AR	196	1176	210	1258	14	82
CARBONDALE IL	17974	46664	19225	49911	1251	3247
WALNUT RIDGE AR	10251	22248	10965	23796	713	1548
PORTAGEVILLE MO	21678	48338	23187	51702	1508	3364
THAYER MO	8414	15256	9000	16318	586	1062
GAINESVILLE MO	1939	5192	2073	5554	135	361
PERRYVILLE AR	3051	5875	3264	6284	212	409
ROLLA MO	26266	58567	28093	62643	1828	4075
MOUNDS IL	4339	10640	4641	11380	302	740
CHESTER IL	55276	119457	59122	127769	3846	8312
POCAHONTAS AR	14465	26955	15471	28831	1007	1876
ELLINGTON MO	141589	98523	151442	105379	9852	6856
DONIPHAN MO	28783	36965	30786	39537	2003	2572
SIKESTON MO	73404	148383	78511	158708	5108	10325
WINONA MO	24126	28332	25805	30303	1679	1971
CAVE CITY AR	3433	8881	3672	9499	239	618
HOUSTON MO	21177	40627	22651	43454	1474	2827
ANNA IL	9148	22430	9785	23991	637	1561
Total	913024	1471447	976557	1573837	63532	102390
Per Visit		1.61		1.61		1.61

Raise surface acres to 3330

Date: 07/14/94 LITTLEROCK Equation
Time: 13:27:24

RESULTS ARE DISPLAYED AS CAMP VISITS AND BENEFITS PER YEAR

Origin	BASELINE # Visits	Benefits	Post-Change # Visits	Benefits	Difference # Visits	Benefits
Site: CLEARWATER						
CAIRO IL	733	2926	810	3233	77	308
POPLAR BLUFF MO	5667	12332	6263	13629	596	1297
CAPE GIRARDEA MO	7862	28002	8688	30946	827	2944
JONESBORO AR	2464	10993	2723	12149	259	1156
AVA MO	235	1171	259	1294	25	123
SALEM AR	630	1854	696	2049	66	195
PARAGOULD AR	1435	5580	1586	6167	151	587
WEST PLAINS MO	1138	3901	1258	4311	120	410
IRONTON MO	3607	7587	3986	8384	379	798
WISEMAN AR	40	421	44	465	4	44
CARBONDALE IL	5203	23846	5750	26353	547	2507
WALNUT RIDGE AR	818	3135	904	3464	86	330
PORTAGEVILLE MO	1168	4598	1291	5081	123	483
THAYER MO	693	2220	766	2454	73	233
GAINESVILLE MO	161	763	178	843	17	80
PERRYVILLE AR	402	1366	444	1509	42	144
ROLLA MO	2361	9294	2609	10272	248	977
MOUNDS IL	612	2648	676	2926	64	278
CHESTER IL	3799	14496	4198	16020	399	1524
POCAHONTAS AR	791	2604	875	2878	83	274
ELLINGTON MO	4946	6082	5466	6721	520	639
DONIPHAN MO	1251	2837	1382	3136	131	298
SIKESTON MO	3421	12212	3781	13496	360	1284
WINONA MO	1506	3125	1665	3454	158	329
CAVE CITY AR	294	1341	325	1482	31	141
HOUSTON MO	1422	4818	1572	5325	150	507
ANNA IL	1514	6553	1673	7242	159	689
Total	54171	176705	59867	195284	5696	18579
Per Visit		3.26		3.26		3.26

Raise surface acres to 3330

Date: 07/14/94 LITTLEROCK Equation
Time: 13:27:28

RESULTS ARE DISPLAYED AS DAY VISITS AND BENEFITS PER YEAR

Origin	BASELINE # Visits	Benefits	Post-Change # Visits	Benefits	Difference # Visits	Benefits
Site: CLEARWATER						
CAIRO IL	8289	18729	9099	20559	810	1829
POPLAR BLUFF MO	185089	227952	203166	250216	18077	22264
CAPE GIRARDEA MO	108639	219112	119250	240513	10611	21400
JONESBORO AR	28560	72183	31349	79233	2789	7050
AVA MO	2363	6676	2594	7328	231	652
SALEM AR	9008	15013	9888	16479	880	1466
PARAGOULD AR	19054	41964	20915	46063	1861	4099
WEST PLAINS MO 29732	57719	32635	633	56	2904	5637
IRONTON MO	56779	67588	62325	74190	5546	6601
WISEMAN AR	196	1176	216	1291	19	115
CARBONDALE IL	17974	46664	19730	51221	1756	4558
WALNUT RIDGE AR	10251	22248	11253	24421	1001	2173
PORTAGEVILLE MO	21678	48338	23796	53060	2117	4721
THAYER MO	8414	15256	9236	16746	822	1490
GAINESVILLE MO	1939	5192	2128	5700	189	507
PERRYVILLE AR	3051	5875	3349	6449	298	574
ROLLA MO	26266	58567	28831	64287	2565	5720
MOUNDS IL	4339	10640	4763	11679	424	1039
CHESTER IL	55276	119457	60674	131124	5399	11667
POCAHONTAS AR	14465	26955	15878	29588	1413	2633
ELLINGTON MO	141589	98523	155418	108146	13829	9623
DONIPHAN MO	28783	36965	31595	40575	2811	3610
SIKESTON MO	73404	148383	80573	162875	7169	14492
WINONA MO	24126	28332	26482	31099	2356	2767
CAVE CITY AR	3433	8881	3768	9749	335	867
HOUSTON MO	21177	40627	23245	44595	2068	3968
ANNA IL	9148	22430	10042	24621	893	2191
Total	913024	1471447	1002198	1615161	89174	143714
Per Visit		1.61		1.61		1.61

Raise surface acres to 3960

Date: 07/14/94 LITTLEROCK Equation
Time: 13:30:38

RESULTS ARE DISPLAYED AS camp VISITS AND BENEFITS PER YEAR

Origin	BASELINE # Visits	Benefits	Post-Change # Visits	Benefits	Difference # Visits	Benefits
Site: CLEARWATER						
CAIRO IL	733	2926	830	3313	97	387
POPLAR BLUFF MO	5667	12332	6417	13963	750	1631
CAPE GIRARDEA MO	7862	28002	8902	31705	1040	3704
JONESBORO AR	2464	10993	2790	12447	326	1454
AVA MO	235	1171	266	1325	31	155
SALEM AR	630	1854	713	2099	83	245
PARAGOULD AR	1435	5580	1625	6318	190	738
WEST PLAINS MO	1138	3901	1288	4417	151	516
IRONTON MO	3607	7587	4084	8590	477	1003
WISEMAN AR	40	421	45	477	5	56
CARBONDALE IL	5203	23846	5892	27000	688	3154
WALNUT RIDGE AR	818	3135	926	3549	108	415
PORTAGEVILLE MO	1168	4598	1322	5206	154	608
THAYER MO	693	2220	785	2514	92	294
GAINESVILLE MO	161	763	183	864	21	101
PERRYVILLE AR	402	1366	455	1546	53	181
ROLLA MO	2361	9294	2673	10524	312	1229
MOUNDS IL	612	2648	693	2998	81	350
CHESTER IL	3799	14496	4301	16413	502	1917
POCAHONTAS AR	791	2604	896	2949	105	344
ELLINGTON MO	4946	6082	5600	6886	654	804
DONIPHAN MO	1251	2837	1416	3213	165	375
SIKESTON MO	3421	12212	3873	13828	452	1615
WINONA MO	1506	3125	1705	3539	199	413
CAVE CITY AR	294	1341	333	1519	39	177
HOUSTON MO	1422	4818	1610	5456	188	637
ANNA IL	1514	6553	1714	7420	200	867
Total	54171	176705	61336	200078	7165	23373
Per Visit		3.26		3.26		3.26

Raise surface acres to 3960

Date: 07/14/94 LITTLEROCK Equation
Time: 13:30:42

RESULTS ARE DISPLAYED AS day VISITS AND BENEFITS PER YEAR

Origin	BASELINE # Visits	Benefits	Post-Change # Visits	Benefits	Difference # Visits	Benefits
Site: CLEARWATER						
CAIRO IL	8289	18729	9307	21029	1018	2299
POPLAR BLUFF MO	185089	227952	207811	255937	22722	27985
CAPE GIRARDEA MO	108639	219112	121976	246012	13337	26899
JONESBORO AR	28560	72183	32066	81044	3506	8862
AVA MO	2363	6676	2653	7496	290	820
SALEM AR	9008	15013	10114	16856	1106	1843
PARAGOULD AR	19054	41964	21394	47116	2339	5152
WEST PLAINS MO	29732	57719	33382	64805	3650	7086
IRONTON MO	56779	67588	63750	75886	6971	8298
WISEMAN AR	196	1176	221	1320	24	144
CARBONDALE IL	17974	46664	20181	52392	2207	5729
WALNUT RIDGE AR	10251	22248	11510	24980	1259	2731
PORTAGEVILLE MO	21678	48338	24340	54273	2661	5934
THAYER MO	8414	15256	9447	17129	1033	1873
GAINESVILLE MO	1939	5192	2177	5830	238	637
PERRYVILLE AR	3051	5875	3426	6596	375	721
ROLLA MO	26266	58567	29490	65757	3225	7190
MOUNDS IL	4339	10640	4872	11946	533	1306
CHESTER IL	55276	119457	62061	134122	6786	14665
POCAHONTAS AR	14465	26955	16241	30264	1776	3309
ELLINGTON MO	141589	98523	158972	110618	17382	12095
DONIPHAN MO	28783	36965	32317	41503	3534	4538
SIKESTON MO	73404	148383	82415	166599	9011	18216
WINONA MO	24126	28332	27088	31810	2962	3478
CAVE CITY AR	3433	8881	3855	9972	421	1090
HOUSTON MO	21177	40627	23777	45614	2600	4988
ANNA IL	9148	22430	10271	25184	1123	2754
Total	913024	1471447	1025112	1652089	112087	180642
Per Visit		1.61		1.61		1.61

Raise surface acres to 5040

Date: 07/14/94 LITTLEROCK EQUATION
Time: 13:34:58

RESULTS ARE DISPLAYED AS CAMP VISITS AND BENEFITS PER YEAR

Origin	BASELINE # Visits	Benefits	Post-Change # Visits	Benefits	Difference # Visits	Benefits
Site: CLEARWATER						
CAIRO IL	733	2926	859	3426	125	501
POPLAR BLUFF MO	5667	12332	6637	14443	970	2111
CAPE GIRARDEA MO	7862	28002	9207	32794	1345	4792
JONESBORO AR	2464	10993	2885	12875	422	1881
AVA MO	235	1171	275	1371	40	200
SALEM AR	630	1854	737	2171	108	317
PARAGOULD AR	1435	5580	1680	6535	246	955
WEST PLAINS MO	1138	3901	1333	4569	195	668
IRONTON MO	3607	7587	4224	8885	617	1298
WISEMAN AR	40	421	47	493	7	72
CARBONDALE IL	5203	23846	6094	27927	891	4081
WALNUT RIDGE AR	818	3135	958	3671	140	536
PORTAGEVILLE MO	1168	4598	1368	5385	200	787
THAYER MO	693	2220	812	2600	119	380
GAINESVILLE MO	161	763	189	894	28	131
PERRYVILLE AR	402	1366	470	1599	69	234
ROLLA MO	2361	9294	2765	10885	404	1591
MOUNDS IL	612	2648	716	3101	105	453
CHESTER IL	3799	14496	4449	16977	650	2481
POCAHONTAS AR	791	2604	927	3050	135	446
ELLINGTON MO	4946	6082	5792	7123	846	1041
DONIPHAN MO	1251	2837	1465	3323	214	486
SIKESTON MO	3421	12212	4006	14302	585	2090
WINONA MO	1506	3125	1764	3660	258	535
CAVE CITY AR	294	1341	344	1571	50	230
HOUSTON MO	1422	4818	1665	5643	243	825
ANNA IL	1514	6553	1773	7675	259	1122
Total	54171	176705	63442	206947	9271	30242
Per Visit		3.26		3.26		3.26

Raise surface acres to 5040

Date: 07/14/94 LITTLEROCK EQUATION
Time: 13:35:02

RESULTS ARE DISPLAYED AS DAY VISITS AND BENEFITS PER YEAR

Origin	BASELINE # Visits	Benefits	Post-Change # Visits	Benefits	Difference # Visits	Benefits
Site: CLEARWATER						
CAIRO IL	8289	18729	9604	21701	1315	2972
POPLAR BLUFF MO	185089	227952	214454	264118	29365	36166
CAPE GIRARDEA MO	108639	219112	125875	253875	17236	34763
JONESBORO AR	28560	72183	33091	83635	4531	11452
AVA MO	2363	6676	2738	7735	375	1059
SALEM AR	9008	15013	10437	17395	1429	2382
PARAGOULD AR	19054	41964	22077	48622	3023	6658
WEST PLAINS MO	29732	57719	34449	66876	4717	9157
IRONTON MO	56779	67588	65788	78312	9008	10723
WISEMAN AR	196	1176	228	1362	31	187
CARBONDALE IL	17974	46664	20826	54067	2852	7403
WALNUT RIDGE AR	10251	22248	11878	25778	1626	3530
PORTAGEVILLE MO	21678	48338	25118	56007	3439	7669
THAYER MO	8414	15256	9749	17676	1335	2420
GAINESVILLE MO	1939	5192	2246	6016	308	824
PERRYVILLE AR	3051	5875	3536	6807	484	932
ROLLA MO	26266	58567	30433	67859	4167	9292
MOUNDS IL	4339	10640	5028	12328	688	1688
CHESTER IL	55276	119457	64045	138409	8770	18952
POCAHONTAS AR	14465	26955	16760	31232	2295	4277
ELLINGTON MO	141589	98523	164053	114154	22464	15631
DONIPHAN MO	28783	36965	33350	42830	4567	5865
SIKESTON MO	73404	148383	85050	171924	11646	23542
WINONA MO	24126	28332	27953	32827	3828	4495
CAVE CITY AR	3433	8881	3978	10291	545	1409
HOUSTON MO	21177	40627	24537	47072	3360	6446
ANNA IL	9148	22430	10600	25989	1451	3559
Total	913024	1471447	1057880	1704898	144855	233451
Per Visit		1.61		1.61		1.61

Appendix E
Computer Source Code

The following code is in the dBase IV language and is written to be compiled in a stand-alone version for use on IBM-compatible PC's.

```
*This is the RRDM dbase code
*It is broken into procedures that access data bases to simplify the
*    manipulation by a user
*
*  The procedures are commented before performed.
*  Each comment gives information on the procedure
*  Comments can not be complete enough to fulfill people unfamiliar
*  with the DbaseIV language.
*
*
*
* set environment
*

set path to actual
clear all
clear
set talk off
set safety off
set decimals to 8
set delete on
public yrfilt, sitefilt, equn_opt, mpre,NASH, PMAX

* initialize
  yrfilt   = '.T.'
  sitefilt = '.T.'
  equn_opt =  1
  mpre     = .F.
  pmax     =  0
  NASH     = .F.
*
* These variables control what are valid
* options in the primary menu
*

public start_done, reset_done
*
* initialize
*
  no_start  = .T.
  no_reset  = .T.
  no_fict   = .T.
  fake      = .F.
  new_sim   = .F.
  upload    = .F.
  calibrat  = .T.

* Define main menu
*
define popup frstmenu from 5,5 message "MAIN MENU"
define bar 1 of frstmenu prompt  "  1. SELECT A PROJECT:" SKIP
define bar 2 of frstmenu prompt  "     1.1 Select Existing Study Project" skip for fake .or. upload
define bar 3 of frstmenu prompt  "     1.2 Define Non-Study Project" skip for new_sim .or. upload
define bar 4 of frstmenu prompt  "     1.3 Upload Baseline Data " skip for new_sim .or. fake
define bar 5 of frstmenu prompt  "=============================================================" skip
define bar 6 of frstmenu prompt  "  2. PROCESS BASELINE DATA:"SKIP
define bar 7 of frstmenu prompt  "     2.1 Read Data,Calibrate,Compute Baseline Demand /Benefits" skip for
no_start
define bar 8 of frstmenu prompt  "     2.2 Go to Changes Menu" skip for (no_start .or. no_reset) .and.
no_fict
```

```
define bar 9 of frstmenu prompt  "================================================================" skip
define bar 10 of frstmenu prompt "  3.  START OVER (Without Exiting the Model)"
define bar 11 of frstmenu prompt "  4.  QUIT model (To DOS Prompt)"
on selection popup frstmenu do model
*
* Activate main menu
*
activate popup frstmenu
* Finished
* Clean up files
 clear all
  clear
 erase tz.dbf
 erase tz.mdx
 erase ts.dbf
 erase ts.mdx
 erase tc.mdx
 erase tc.dbf
 erase tsz.mdx
 erase tsz.dbf
set talk on
set delete on
set safety on
set decimals to 2
return

procedure model

do case
  case bar() = 2
     do get_scope
     no_start = .F.
     no_reset = .T.
     new_sim  = .T.

  case bar() = 3
     set path to planned
     do c_fict
     do get_scope
     no_start = .F.
     no_reset = .T.
     no_fict  = .T.
     fake     = .T.

  case bar() = 4
     do read_predata
     no_fict  = .F.
     no_reset = .F.
     upload   = .T.
     no_start = .F.

  case bar() = 7

     if .not. upload
                                    do create_files
                                    calibrat =.F.

     endif

     if calibrat
                                    do calibrate

     endif

     mpre     = .T.
     do domodel
     no_reset = .F.

  case bar() = 8
```

```
      do edit_vars
      mpre = .F.
      do domodel
      do report


   case bar() = 10
      no_start = .T.
      no_reset = .T.
      no_fict  = .T.
      fake     = .F.
      new_sim  = .F.
      upload   = .F.
      set path to actual
      close databases

  case bar() = 11
deactivate popup
endcase
return

procedure get_scope
*
*  routine to create the year filter, site filter and equation option
*
*  this modifies the public variables:
*     yearfilt - filter for year e.g. 'year=1985'
*     sitefilt - filter for site
*     equn_opt  - option for equation
*                 1  - pooled equation
*                 2 - district specific equation
*
*
*
*  program assumes all data files are closed
*  and will return with all files closed
*
*
* routines needed are:
*
* execute
*
use cost
*
*do get_year_filt is commented out so it may be implemented if needed in the future
*all data bases have 1983-1986 data in them the year is set to 1985 for current use
*
* do get_year_filt
yrfilt = "year = 1985"
use site
set filter to &yrfilt
do get_site_filt
use
do get_eqn_opt
return



procedure get_eqn_opt
*
* routine to get equation option
*    equation option is public variable equn_opt
*
define popup seleqn from 10,10 message "SELECT EQUATION MENU"
define bar 1 of seleqn prompt "use pooled equation"
define bar 2 of seleqn prompt "use district specific equation"
on selection popup seleqn do get_bar with equn_opt
*
* default option is 1
```

```
*
equn_opt = 1
activate popup seleqn
*
* clean up
*
release popup seleqn
return


procedure get_year_filt
*
*  routine to build year filter and return cost per mile
*    yrfilt year filter - default is firdt record of data base
*    m_vcmile
*
*  year file must be currently selected to use this file
*
*  year_filt is disabled, default is set to 1985 for data set
*  no year choice can be made unless reinstated
define popup sel_year from 10,10 message "SELECT YEAR MENU";
                                                    prompt field year
on selection popup sel_year do get_bar with mrec

mrec = 0
activate popup sel_year
if mrec < 1
  goto top
else
  goto mrec
endif
yrfilt = "year="+str(year,4)
release popups sel_year
return



procedure get_site_filt
*
*  routine to build filter condition for sites
*    parameter sitefilt returns proper filter for site selection
*
*
*  choices are all sites, all sites within a zone and one site
*
*  site file must be currently selected
*
define popup sel_site from 10,10 message "GEOGRAPHIC SCOPE MENU: "
define bar 1 of sel_site prompt "All Projects"
define bar 2 of sel_site prompt "One Project"
define bar 3 of sel_site prompt "One District"
on selection popup sel_site do get_bar with mb

define popup sel_ind_s from 10,20 message "PROJECT MENU" prompt field site
on selection popup sel_ind_s do get_prompt with msite

define popup sel_ind_d from 10,20 message "DISTRICT MENU";
                                        prompt field district
on selection popup sel_ind_d do get_prompt with msite
*
* start programs
*  .t. is default site filter
*
sitefilt='.t.'
*
* garbage msite is cue to see if one escaped out of district or site menu
*
msite = '@!#'
mb = 0
```

```
activate popup sel_site
do case
  case bar() = 2
       set order to tag site
       activate popup sel_ind_s
       sitefilt=iif(msite<>'@!#',"site='"+msite+"'",'.t.')
  case bar() = 3
       set order to tag udist
       activate popup sel_ind_d
       sitefilt=iif(msite<>'@#!',"district='"+msite+"'",'.t.')
endcase
*
* clean up
*
release popups sel_site,sel_ind_d,sel_ind_s
return


procedure get_bar
parameters mbar
*
*  routine to close popup and return choice number
*
mbar=bar()
deactivate popup
return


procedure get_prompt
parameters mprompt
*
* routine to close popup and return choice description
*
mprompt=prompt()
deactivate popup
return

function entexp
parameters msg
m_exp = space(128)
ic = int((77-len(msg))/2)
define window w_exp from 10,ic to 15,ic+len(msg)+2
ic = "S"+rtrim(ltrim(str(len(msg)-2,2)))
activate window w_exp
clear gets
@ 1,0 say msg
@ 2,2 get m_exp function ic
read
clear gets
m_exp = ltrim(rtrim(m_exp))
deactivate window entexp
release window w_exp
return m_exp

function yesno
parameters msg
vyn = .f.
winlen = 20+max(12,len(msg)+4)
define window w_yesno from 8,20 to 13,winlen
define menu m_yesno
define pad yes of m_yesno prompt "Yes" at 3,2
define pad no of m_yesno prompt "No" at 3,7
on selection pad yes of m_yesno do deacyn with .t.,vyn
on selection pad no of m_yesno do deacyn with .f.,vyn
activate window w_yesno
@ 1,2 say msg
activate menu m_yesno
deactivate window w_yesno
return (vyn)
```

```
procedure deacyn
parameters ch,vyn
vyn = ch
deactivate menu
return


procedure calibrate
if yesno ('DO YOU WISH TO CALIBRATE THE MODEL?')
   sele ts
   goto top
   browse fields district/r, site/r, c_c, c_d noappend nodelete lock 1
endif
return


procedure save_data
*
*  this routine saves temporary data base files to the WORK subdirectory in
*  the main RRDM directory.
*

fname = upper(entexp('ENTER NAME TO SAVE DATA UNDER'))

*
*   check for valid file name
*   no dots in file name
*   no illegal characters
*   file already exists
*
*
create view work\&fname from environment
close databases
copy file ts.dbf to work\&fname..tsd
copy file ts.mdx to work\&fname..tsx
copy file tz.dbf to work\&fname..tzd
copy file tz.mdx to work\&fname..tzx
copy file tc.dbf to work\&fname..tcd
copy file tsz.dbf to work\&fname..szd
copy file tsz.mdx to work\&fname..szx
set view to work\&fname
sele 5
seek " POOLEDDATA"
sele 1
return


procedure read_predata
*  this routine reads previously saved data for pre-policy data from the WORK directory and
*  loads it for continuing a previous session.
*

define popup upload from 10,10 prompt files like work\*.vue
on selection popup upload do get_prompt with fname
fname="!@#$%"
activate popup upload
if fname<>"!@#$%"
   fname = left (fname, len(fname)-4)
   close databases
   copy file &fname..tsd to ts.dbf
   copy file &fname..tsx to ts.mdx
   copy file &fname..tzd to tz.dbf
   copy file &fname..tzx to tz.mdx
   copy file &fname..tcd to tc.dbf
   copy file &fname..szd to tsz.dbf
   copy file &fname..szx to tsz.mdx
   set view to &fname
```

```
    sele 5
    seek " POOLEDDATA"
    sele 1
endif
return


procedure read_postdata
*  this routine reads previously saved data for post-policy data from the WORK directory and
*  loads it for continuing a previous session.
*
define popup upload from 10,10 prompt files like work\*.vue
on selection popup upload do get_prompt with fname
fname="!@#$%"
activate popup upload
if fname<>"!@#$%"
   fname = left (fname, len(fname)-4)
   close databases
   copy file &fname..tsd to ts.dbf
   copy file &fname..tsx to ts.mdx
   copy file &fname..tzd to tz.dbf
   copy file &fname..tzx to tz.mdx
   copy file &fname..tcd to tc.dbf
   set view to &fname
   sele 5
   seek " POOLEDDATA"
   sele 1
endif
return


procedure create_files
*
*  routine to create temporary files for simulation
*  and use these files with proper relations set up
*
*  this programs closes all databases and creates new environment
*
*   It expects the following public variables
*     yrfilt - year filter
*     sitefilt - site filter
*     equn_opt - option number for equation type
*                1 - pooled equation
*                2 - district specific equation
*
*
close databases
*
* coefficient file is not copied to temporary file
*
@ 18,15
@ 18,15 say "Creating Temporary Coefficent File"
sele 5
use mod_coef
copy to TM with production
use TM alias beta order tag district
*
* cost file
*
@ 18,15
@ 18,15 say "Creating temporary cost file"
sele 4
use cost
copy to tc for &yrfilt
use tc
*
* create site file
*
@ 18,15
```

```
@ 18,15 say "Creating site file"
sele 3
use site

Copy to ts for &sitefilt .and. &yrfilt with production
use ts order tag site

*  allow user to calubrate the model with a menu choice
*  THIS IS DONE BY BROWSING THE TS FILE AND CHANGING THE C_D AND C_C
*  FIELS.  THE DEFAULT FOR THESE FIELDS IS 1.

*  allow user to calibrate model

do calibrate


*
* site & zone combination file
*
@ 18,15
@ 18,15 say "Creating temporary site-zone file"
sele 1
use sitezone
set fields to site,district,zone_cit,year,miles,time,;
                                          pre_day=0, pre_camp=0, post_day=0, post_camp=0,;
                                          pre_bday=0,pre_bcamp=0,post_bday=0,post_bcamp=0
copy to tsz for &sitefilt .and. &yrfilt with production
use tsz order tag zone_cit
*
* zone file - copy only those origin cites that are with sites selected
*
@ 18,15
@ 18,15 say "Creating temporary zone file "
sele 2
use zone
set relation to zone_cit into tsz
copy to tz for found('tsz').and. &yrfilt with production
use tz order tag zone_cit
@ 18,15
*
* set up relations
*
if equn_opt = 2
  sele ts
  set relation to district into beta
else
  sele 5
  seek " POOLEDDATA"
endif
sele 1
set order to
set relation to site into ts,zone_cit into tz
return

PROCEDURE DOMODEL
*
*
*  PROCEDURE TO COMPUTE VALUE OF DEMAND FUNCTION
*
*  FOUR FILES MUST BE IN USE
*     ALIAS       CONTENTS
*  ************************
*     TSZ         LINE FOR EVERY SITEXZONE COMBINATION
*     TS          LINE FOR EVERY SITE
*     TZ          LINE FOR EVERY ZONE
*     BETA        COEFFICIENTS FILE, POINTER MUST BE AT PROPER LINE
*
*  TSZ AND TS AND TZ ARE RELATED IN THE OBVIOUS WAY
*
```

```
*  VCMILE IS COST PER MILE
*  MPRE IS LOGICAL TRUE IF THIS COMPUTES PRE-POLICY RATES
*
SELECT TSZ
GOTO TOP



DO WHILE .NOT. EOF()


*
* THIS TAKES CARE OF PROBLEMS WITH PRICE COEFICIENT ON NASHVILLE DISTRICTS
*
  IF DISTRICT = " NASHVILLE"

                                        NASH =.T.

  ELSE
                                        NASH =.F.
  ENDIF

  TEMPD = exp(BETA->D_INT)
  TEMPC = exp(BETA->C_INT)

* PERCENTAGE SURFACE AREA
  IF TS->ACRES > 1.0
    TEMPD = TEMPD*101^BETA->D_PERCENT
    TEMPC = TEMPC*101^BETA->C_PERCENT
  ELSE
    TEMPD = TEMPD * (100*TS->ACRES+1)^BETA->D_PERCENT
    TEMPC = TEMPC * (100*TS->ACRES+1)^BETA->C_PERCENT
  ENDIF

* COEFF OF VARIATION
  TEMPD = TEMPD * (TS->CV+1)^BETA->D_CV
  TEMPC = TEMPC * (TS->CV+1)^BETA->C_CV

* AVERAGE RES SA
  TEMPD = TEMPD * (TS->SUR_AC*TS->ACRES+1)^BETA->D_SUR_AC
  TEMPC = TEMPC * (TS->SUR_AC*TS->ACRES+1)^BETA->C_SUR_AC

* SHORELINE AND PEOPLE
  TEMPD = TEMPD * (TS->SHORE+1)^BETA->D_SHORE * (TZ->PEOPLE)^BETA->D_PEOPLE
  TEMPC = TEMPC * (TS->SHORE+1)^BETA->C_SHORE * (TZ->PEOPLE)^BETA->C_PEOPLE

* COSTS
  COSTD = (2*MILES* TC->VCMILE + TS->DFEE)/TS->CAR_LOAD + 2*TIME*TZ->WAGES/2000/3 + 1
  COSTC = (2*MILES* TC->VCMILE + TS->CFEE)/TS->CAR_LOAD + 2*TIME*TZ->WAGES/2000/3 + 1
  TEMPD = TEMPD * COSTD^BETA->D_PRICE
  TEMPC = TEMPC * COSTC^BETA->C_PRICE

* INCOME AND UNEMPLOYMENT
  TEMPD = TEMPD * TZ->INCOME^BETA->D_INCOME * TZ->NO_WORK^BETA->D_NO_WORK
  TEMPC = TEMPC * TZ->INCOME^BETA->C_INCOME * TZ->NO_WORK^BETA->C_NO_WORK

* PERCENT UNDER 18
  TEMPD = TEMPD * (TZ->UNDER_18*100+1)^BETA->D_UNDER_18
  TEMPC = TEMPC * (TZ->UNDER_18*100+1)^BETA->C_UNDER_18

* PERCENT OVER 65
  TEMPD = TEMPD * (TZ->OVER_65*100+1)^BETA->D_OVER_65
  TEMPC = TEMPC * (TZ->OVER_65*100+1)^BETA->C_OVER_65

* BLACKS AND HISPANICS
  TEMPD = TEMPD * ((TZ->BLACK+TZ->HISPANIC)*100+1)^BETA->D_MINOR
  TEMPC = TEMPC * ((TZ->BLACK+TZ->HISPANIC)*100+1)^BETA->C_MINOR
```

```
* MILES TO AN OCEAN
  TEMPD = TEMPD * (Tz->OCEAN+1)^BETA->D_OCEAN
  TEMPC = TEMPC * (Tz->OCEAN+1)^BETA->C_OCEAN

* SUBST RESERVOIR sa
  TEMPD = TEMPD * (Tz->SUB_INX+1)^BETA->D_SUB_INX
  TEMPC = TEMPC * (Tz->SUB_INX+1)^BETA->C_SUB_INX

* MORFO EDAPHIC INDEX
  TEMPD = TEMPD * (TS->TDS/TS->DEPTH+1)^BETA->D_MORPH
  TEMPC = TEMPC * (TS->TDS/TS->DEPTH+1)^BETA->C_MORPH

* TDS
  TEMPD = TEMPD * (TS->TDS+1)^BETA->D_TDS
  TEMPC = TEMPC * (TS->TDS+1)^BETA->C_TDS

* SPECIES
  TEMPD = TEMPD * (TS->SPECIES+1)^BETA->D_SPECIES
  TEMPC = TEMPC * (TS->SPECIES+1)^BETA->C_SPECIES

* PICNIC * CAMPS
  TEMPD = TEMPD * (TS->PICNIC+1)^BETA->D_PICNIC * (TS->CAMPS+1)^BETA->D_CAMPS
  TEMPC = TEMPC * (TS->PICNIC+1)^BETA->C_PICNIC * (TS->CAMPS+1)^BETA->C_CAMPS

* PARKING AND LANES
  TEMPD = TEMPD * (TS->PARKING+1)^BETA->D_PARKING * (TS->LANES+1)^BETA->D_LANES
  TEMPC = TEMPC * (TS->PARKING+1)^BETA->C_PARKING * (TS->LANES+1)^BETA->C_LANES

* BEACHES AND MARINAS
  TEMPD=TEMPD* (TS->BEACHES+1)^BETA->D_BEACHES * (TS->MARINAS+1)^BETA->D_MARINAS
  TEMPC=TEMPC* (TS->BEACHES+1)^BETA->C_BEACHES * (TS->MARINAS+1)^BETA->C_MARINAS

*  DOCKS
  TEMPD = TEMPD * (TS->DOCKS+1)^BETA->D_DOCKS
  TEMPC = TEMPC * (TS->DOCKS+1)^BETA->C_DOCKS

*allow for calibration of the model with the C factor variable
* C_D FOR DAY
* C_C FOR CAMPING
*this variable is in the site data base and assumes a default value of 1
*the user changes this variable if needed to shift demand by some constant

  TEMPD = TEMPD * (TS->C_D)
  TEMPC = TEMPC * (TS->C_C)
*
* before replacing records get some values that depend on which district
*
* compute benefits $1000 is arbitrary maximum price
* MO_SEASON IS THE RECREATION MONTHS OUT OF THE YEAR
*
  IF NASH
    PMAX = 50
    MO_SEASON = 8
  ELSE
    PMAX = 1000
    MO_SEASON = 9
  ENDIF

*  f is the expansion from monthly to annual visits
*
  f = mo_season/ts->percent

*
* DONE REPLACE RECORDS
*   to account for a cost coefficient > -1, work from a large price
*   danger - -1 for beta->x_price  will cause problems
*
  IF MPRE
   REPL PRE_DAY WITH TEMPD*f,PRE_CAMP WITH TEMPC*f
```

```
  ELSE
   REPL POST_DAY WITH TEMPD*f, POST_CAMP WITH TEMPC*f
  ENDIF
*
*day trips
*
  b1 = beta->d_price+1
  tb = pmax^b1 - costd^b1
  tempd = tempd/b1/costd^beta->d_price*tb



*
*   camping trips
*
  b1 = beta->c_price+1
  tb = pmax^b1 - costc^b1
  tempc = tempc/b1/costc^beta->c_price*tb
*
* replace records
*
 if mpre
    repl pre_bday with tempd*f,pre_bcamp with tempc*f
  else
    repl post_bday with tempd*f,post_bcamp with tempc*f
  endif

  @ $,60 SAY RECNO()

 if mpre
    @ 2,9 say "COMPUTING PRE-POLICY VISITS"
 else
    @ 2,9
 endif
SKIP
ENDDO
RETURN


procedure edit_vars
*
* routine to edit site and zone variables
* temporary files are in assumed in use as ts and tz for site & zone
*
*  define popup associated with this option
*    logical variables indicate when editing has taken place
*
define popup edit_menu from 10,10 message "2.4 IMPLEMENT MANAGEMENT CHANGES MENU"
define bar 1 of edit_menu prompt " Make Changes to Project Facilities and Fees"skip for .not. esite
define bar 2 of edit_menu prompt "    Redo Changes to Project Facilities,Fees " skip for esite
define bar 3 of edit_menu prompt " Make Changes to Zone Demographics " skip for .not. ezone
define bar 4 of edit_menu prompt "    Redo Changes to Zone Demographics " skip for ezone
define bar 5 of edit_menu prompt "                                                "skip
define bar 6 of edit_menu prompt "================================================" skip
define bar 7 of edit_menu prompt "========================================" skip
define bar 8 of edit_menu prompt " Save Changes to a File on Harddisk"
define bar 9 of edit_menu prompt " Upload a File with Saved Changes "
define bar 10 of edit_menu prompt " Compute Visitation/Benefits with Management Changes "

on selection popup edit_menu do get_bar with mb
*
*  invoke menu
*
mb = 0
esite = .t.
ezone = .t.
eint  = .t.
do while .t.
  activate popup edit_menu
```

```
  @ 5,0
  do case
    case mb = 1 .or. mb = 2
     sele ts
     goto top
     browse fields site/r,district/r,docks,marinas,beaches,lanes,parking,camps,;
                                        picnic,species,tds,shore,sur_ac,acres,cfee,dfee,cv,depth
noappend nodelete lock 2
     esite = .f.
    case mb = 3 .or. mb = 4
     sele tz
     goto top
     browse fields zone_cit/r,people,income,no_work,under_18,over_65,black,;
                                        hispanic,sub_inx,ocean noappend nodelete lock 1
     ezone = .f.


    case mb = 8
     do save_data

    case mb = 9
     do read_postdata

    case mb = 10
     exit
  endcase
enddo

*
* done - clean up
*
release popups edit_menu
select tsz
return


procedure c_fict

*  this routine allows the user to make the site, zone, sitezone, and
*  cost data bases.
*
*   Time is calculated on miles which can be changed
*
close databases
*
* create a site database
*
use site
set form to siteform
edit noappend

*
* create a zone database
*
use zone
set form to zoneform
edit
replace all year with 1985

*
* create a cost data base
*
use cost
set form to costform
edit noappend

*
* create a site-zone database
*
```

```
use zone
use site in select()
set fields to zone->zone_cit, site->site, site->district, site->year, miles=150, time=0.0, mt = .136 + (.02)
* miles
join with site to planned\sitezone for .T.
use sitezone
index on site tag site
index on zone_cit tag zone_cit
set fields to site /r, district, zone_cit /r, year, miles, mt=.136 + (.02) * miles, time
set form to szform
edit noappend
replace time with mt
set fields to
set form to szform
set form to
set fields to
close databases
return


PROCEDURE REPORT
*
*  do reports -FIRT ASK WHERE THEY WANT THE REPORTS TO GO
*
*

DEFINE POPUP selout from 10,10 message " SEND OUTPUT MENU"
define bar 1 of selout prompt "TO THE SCREEN"
define bar 2 of selout prompt "TO A PRINTER"
define bar 3 of selout prompt "TO A FILE"
oopt = 0
on selection popup selout do get_bar with oopt
activate popup selout
sele tsz
*
*set order to tag site
*
line=0
device="screen"
title = entexp("ENTER A TITLE FOR OUTPUT PAGE")
do case
  case oopt = 2
    set print on
    device = "printer"
  case oopt = 3
    device = "file"
    mfile = entexp(" Enter file name ")
    set alternate to &mfile
    set alternate on
endcase
summ =  yesno(' Summary report only? ')
clear
do prnvar with "camp",device,title,summ,line
do prnvar with "day",device,title,summ,line
do pgejct with device
*
*  clean up
*
set print off
set alternate to
release popups selout
no_start = .T.
no_reset = .T.
no_fict  = .T.
fake     = .F.
new_sim  = .F.
return
```

```
procedure prnvar
parameters var,device,hdng,summ,lst

*
*  TEST ROUTINE TO PRINT REPORT GENERATED FROM RRDM
*
*     VAR - NAME OF VARIABLE TO BE PRINTED
*           PRE_&VAR IS PRE-MANAGEMENT CHANGES VISTATION RATE
*           POST_&VAR IS POST MANAGEMENT VISITTION RATE
*           PRE_B&VAR IS PRE MANAGEMENT BENEFITS
*           POST_&VAR IS POST-MANAGEMENT BENEFITS
*
*           VAR IS "camp" OR "day"
*
*     DEVICE - WHERE OUTPUT GOES
*              "PRINTER" - PRINTER
*              "SCREEN" - SCREEN
*          ANYTHING ELSE  - FILE WHOSE NAME IS CONTAINED IN DEVICE
*
*     HDNG - HEADING
*
*     SUMM - logical .t. if summary report only
*
*     LST  - STARTING LINE NUMBER
*            0 - NO EJECT
*            BIG NUMBER WILL CAUSE AN EJECT AT BEGINNING
*            OTHER NUMBER WILL CAUSE PRINTING TO START AT MIDDLE OF PAGE
*            returns line position at end of report
*
*
* TSZ MUST BE IN USE, talk must be off already
*
public line_at,sav,sbv,sab,sbb,bog,lnpg
goto top
bog = site
bv = "pre_"+var
av = "post_"+var
bb = "pre_b"+var
ab = "post_b"+var
line_at = lst

if upper(device) = "SCREEN"
  if right(set("display"),2)="43"
    lnpg = 38
  else
    lnpg = 20
  endif
else
  lnpg = 53
endif

if lst+14 > lnpg
  do pgejct with device
endif
do pghdr with var
do boghdr with device,summ,var

do while .not. eof()

* update summary variables

   sbv = sbv + &bv
   sav = sav + &av
   sbb = sbb + &bb
   sab = sab + &ab


*  do detail printing (each site zone combo)
```

```
    if .not. summ
      ?? Zone_cit FUNCTION "T" AT 0,;
         &bv PICTURE "9999999" AT 17,;
         &bb PICTURE "99999999" AT 25,;
         &av PICTURE "9999999" AT 38,;
         &ab PICTURE "99999999" AT 46,;
         &av - &bv PICTURE "9999999" AT 60,;
         &ab - &bb PICTURE "99999999" AT 68
       ?
       line_at = line_at+1
     endif
     if line_at > lnpg
       do pgejct with device
       do pghdr with var
     endif

     skip

  * if end of group do necessary processing

     if site <> bog

  *  print end of group stuff

       if .not. summ
         ?? "Total" AT 11
       else
         ?? bog
       endif
       ?? sbv PICTURE "9999999" AT 17,;
                                      sbb PICTURE "99999999" AT 25,;
                                      sav PICTURE "9999999" AT 38,;
                                      sab PICTURE "99999999" AT 46,;
                                      sav-sbv PICTURE "9999999" AT 60,;
                                      sab-sbb PICTURE "99999999" AT 68
       ?
       ?? "Per Visit" at 7
       ?? iif(sbv>0,sbb/sbv,0) PICTURE "99999.99" at 28, ;
                                      iif(sav>0,sab/sav,0) PICTURE "99999.99" at 49, ;
                                      iif(sav-sbv>0,(sab-sbb)/(sav-sbv),0) PICTURE "99999.99" at 71
       ?
       line_at = line_at + 2


  *    if not end of file print beinning of group

       if .not. eof()
         do boghdr with device,summ,var
       endif
     endif

  *  done
  *
  enddo
  *
  *  clean up
  *
  lst = line_at

  return

  procedure boghdr
  parameters device,summ,var

  if .not. summ
    if line_at > lnpg-6
      do pgejct with device
      do pghdr with var
    endif
```

```
  ?
  ?? "  Site: "+site
  ?
endif
line_at = line_at + 2
sav = 0
sbv = 0
sab = 0
sbb = 0
bog = site
return


procedure pghdr
parameters var
?
?
?? hdng FUNCTION "I;V"+LTRIM(STR(_rmargin - _lmargin))
?
? "Date: "+dtoc(date()) + space(8) + beta->district + " equation"
? "Time: "+time()
?
?? "RESULTS ARE DISPLAYED AS "+var+" VISITS AND BENEFITS PER YEAR" AT 13
?
?
if summ
  ?? "   site   " AT 0
else
  ?? "  origin  " AT 0
endif
?? "   BASELINE" AT 17,;
 "Post-Change" AT 39,;
 "Difference" AT 61
?
?? "# Visits" AT 16,;
 "Benefits" AT 25,;
 "# Visits" AT 37,;
 "Benefits" AT 46,;
 "# Visits" AT 59,;
 "Benefits" AT 68
?
line_at = line_at + 10

RETURN

procedure pgejct
parameters device
do case
   case upper(device) = "SCREEN"
      wait to action
   case upper(device) = "PRINTER"
      eject
endcase
line_at = 0
return
```

Natural Resources Research Program

Recreation Regional Demand Model for Large Reservoirs

-- SOFTWARE ORDER FORM --

Please send _____ copies of the Recreation Regional Demand Model Software to:

Name _____

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3909 Halls Ferry Road
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Facsimile: 601-634-4201
Email: tillman@elmsg.wes.army.mil

Recreation Regional Demand Model Software may also be downloaded via the NRRP/NRTS BBS at 601-634-2683 (Settings, N-8-1/ANSI).

For further assistance on Recreation Regional Demand Model Software contact:

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	October 1995	Final report

4. TITLE AND SUBTITLE
Regional Recreation Demand Model for Large Reservoirs: User's Guide and Model Documentation, Version 1.0

5. FUNDING NUMBERS
WU 32574

6. AUTHOR(S)
Frank A. Ward, Kevin A. Martin

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
New Mexico State University
Las Cruces, NM 88003

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Engineer Waterways Experiment Station
3909 Halls Ferry Road, Vicksburg, MS 39180-6199

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
Instruction Report
R-95-1

11. SUPPLEMENTARY NOTES
Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This report is a user's guide and documentation of a regional recreation demand model estimated for U.S. Army Corps of Engineers (USACE) reservoirs. The software allows managers who use the model to predict recreation visitation and economic benefits at USACE or similar large reservoirs resulting from potential management actions. Access to information provided by this model has the potential to save time and resources when conducting economic appraisals of natural resource management plans.

An estimated travel cost model predicts recreational use and benefits at USACE reservoirs in the Sacramento, Little Rock, and Nashville Corps of Engineers Districts. The data needed by the model are stored in databases that can be accessed through user-friendly computer screens to set up scenarios to evaluate impacts of management actions. There are 23 reservoirs currently in the database. For reservoirs not in the model's existing databases, the user can define the data needed by the model by means of screens that prompt the user to furnish information characterizing reservoir facilities and demographics of the surrounding market area. Resulting model predictions forecast day use and camping use visitation and economic benefits at large reservoirs.

The software can be used by resource managers with limited background in economic analysis. The model complements a manager's detailed understanding of a reservoir, its facilities, its visitors, and characteristics of its market area.

14. SUBJECT TERMS			15. NUMBER OF PAGES
National Economic Development	Recreation demand model	Reservoir recreation	76
Recreation benefits	Recreation visitation model	Travel cost model	16. PRICE CODE
Recreation demand	Regional models		

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED		

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